Welcome to Dr. Leslie C. Coleman at the Air Port, Bangalore, Nov. 1953

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The Mysore Agricultural Journal

(The Organ of the Mysore Agricultural and Experimental Union)

Vol. 30, July to September 1954, No. 3

IN THIS ISSUE

SUGARCANE IMPROVEMENT IN MYSORE
KITCHEN GARDEN FRUITS: BANANA
GRAPES ARE NOT SOUR
PROTECTION OF FARM WOOD WORKS
POTASSIUM UPTAKE OF PADDY PLANTS

The
Mysore Agricultural Journal

(Organ of the Mysore Agricultural and Experimental Union
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Vol. XXX July to September 1954 No. 3

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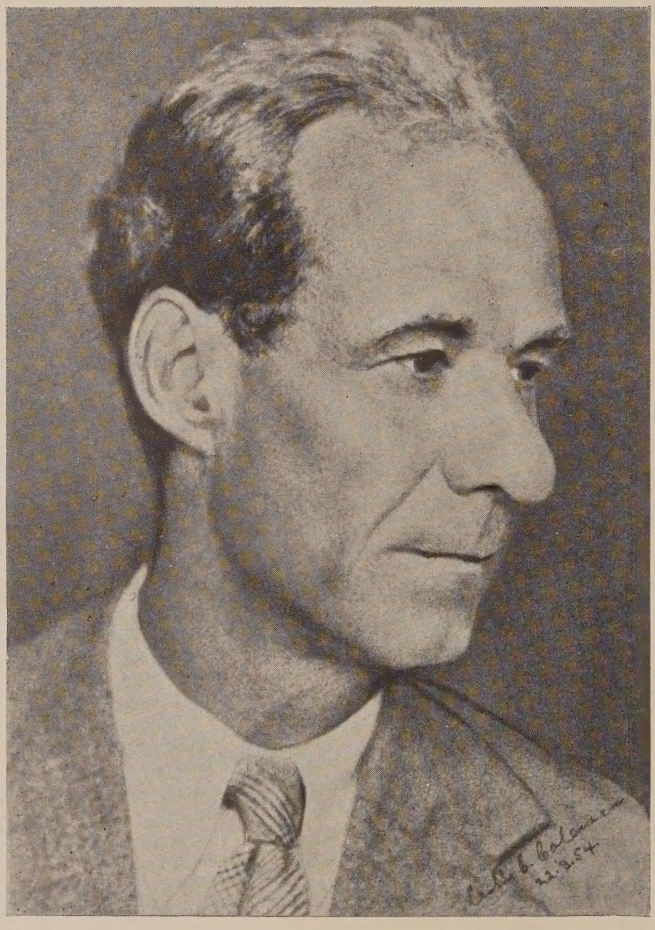


DR. LESLIE C. COLEMAN, M.A., Ph.D., C.I.E.

Born: 16–6–1878 Died: 14–9–1954

Founder, Mysore State Department of Agriculture and Mysore Agricultural and Experimental Union. Director of Agriculture in Mysore, 1913–34

DR. LESLIE C. COLEMAN

June 16, 1878–Sept. 14, 1954

It has come as a great shock to learn that Dr. Coleman was killed in a motor accident on the 14th of this month. It is very hard to believe that such a vivacious, active man who in his recent visit to our State shamed many half his age with his mental and physical vigour and exuberance, is no more. Dr. Coleman would have hated to die in a bed and it is significant that he did not die but was killed.

Born in his father's farm in Ontario in June 16, 1878, he spent his early life, up to the age of thirteen, mostly amid agricultural surroundings. After his country Primary school and village High school he, as an young man spent his holidays working on farms as a day labourer. From the age of 18 till the age of 22, he taught in Primary schools. He entered Toronto University at 22 and received his Degree in 1904 standing first in first class Honours and winning the Governor-General's Gold Medal, the highest award of the University for proficiency in Science and English. He lectured in Biology in the same University during 1904-05. In 1905 he worked in the laboratories of the U.S. Department of Agriculture.

He entered the University of Gottingen in the autumn of 1905 and graduated with the Degree of Ph.D. and citation *Magnecum laude,* the highest given in a German University. In 1906 he worked as a guest in the Imperial Biological Institute for Agriculture and Forestry at Berlin.

In January 1908, Dr. A. Lehmann selected him as Mycologist and Entomologist in Mysore and in the October of the same year he was placed in charge of what was then the Mysore Agricultural Chemist's Department including the Experimental Farm at Hebbal started four years earlier.

In 1913, he became the first Director of Agriculture in Mysore. In 1914-15 he reorganised the entire Department on modern lines with laboratories, research stations and a well-knit Extension Service, though he called it by the less spectacular but more descriptive term of Demonstration Section.

During 1918-19, he organised University Biological teaching for the Canadian Army in England (the Khaki University). Between 1925-27 when he was on long leave, he was Professor of Plant Pathology in the University of Toronto.

Except for these short periods, he was at the helm of the Mysore State Department of Agriculture from 1908 to 1934. This long period is as much a record as many of the great things he did for the improvement of Mysore agriculture. He was among the pioneers of agricultural education, agricultural research, plant protection and agricultural extension in India. When he retired in 1934 he had left behind him a very well organised Department with sound traditions of research and demonstration.

But with his almost dæmonic energy and restlessness he could not remain in secluded retirement for long. Soon after he returned to Canada, he became Research Assistant in Botany in his old *alma mater*. In 1936, he became Professor of Cytology and remained in that post till June 1948.

He was seventy in age when he retired for the second time but it looked as though he was only seventeen in spirit. Immediately thereafter he plunged himself in work as a Fellow of the National Cancer Institute of Canada and chose plant cancers for his research. In 1953, he took leave for 4 months to revisit Mysore—the scene of his early labours, grand achievements and second love. He toured the entire State from December to March, and wrote out his impressions in a bulky volume. He wanted to write his autobiography for which he was making preparations. He had even promised to send a few chapters to this Journal.

It is a great tragedy that he was snatched away all of a sudden. He had expressed that he would revisit the State when he was 85. He would have done it but for this sad end.

His recent visit remains vivid and fresh in the minds of his colleagues and admirers who number in thousands. In his very first lecture after he landed in Bangalore in November last, he said that Canada was his first and the Kannada-speaking Mysore, his second home. Second loves are generally strong and lasting. Dr. Coleman proved it by undertaking the costly air trip from Canada at his own cost and "dipping into his own capital". He came here not for rest, not for reminiscence but to work, to put in 12 to 14 hours a day, every day in the week, including sometimes the Sabbath day, for all the four months of his tour. How many would spend their meagre capital in their late seventies not for pleasure but for work ? How many would risk a long air journey at his age ? Why did he do this ? Because he was always big-hearted ; because he always did things in a big way. Because he just loved ardently Mysore and her people. How many of us are capable of this great love to our own dear Mysore.

Dr. Coleman is no more but his spirit which permeates and animates every room, every microscope, every work-bench and every member of the staff of the Department, lives on for ever. He has carved for himself a deep niche in the hearts of men and institutions of this State which memory cannot efface and age cannot wither. To us, in the Department of Agriculture and in the Agricultural and Experimental Union, he is immortal.

16-9-1954 M. L. N. Iyengar.

A letter since received by the Editor from Miss M. B. Coleman states that on the morning of 14th September her brother was driving his car to his Research Laboratory. He drove off the road on a curve in a pocket of dense fog and struck a cement projection. He was extricated from the car and taken to the hospital where he died within three hours of the accident. Dr. Coleman is survived by two sons, two daughters and two sisters. His first son and daughter were born in India.

Editorial

REVIVAL OF THE BOTANICAL SURVEY OF INDIA

THE Government of India have recently approved the revival and reorganisation of the Botanical Survey of India which was defunct since 1937.

Under the reorganisation scheme, India will be divided into four botanical regions based on phyto-geographical affinities, each under a regional botanist. The headquarters will be Poona for the west, Madras for the south, Calcutta for the east and either Lucknow or Dehra Dun for the north regions. A Chief Botanist with a Central Directorate will co-ordinate the regional activities and implement the policy laid down by the Government. A central botanical laboratory will be established where the living plant will be studied in relation to its biology and utility to the nation. Dr. E. K. Janaki Ammal, who is well known to students of Botany as the co-author with Darlington of the 'Chromosome Atlas of Cultivated Plants' and who has a wide and varied experience at Combatore, John Innes Horticultural Institute and the famous Wisley Gardens of the Royal Horticultural Society, is to head this laboratory as its Director. A Central National Herbarium to house the type specimens and a fully representative collection of the plants of India will be maintained. It is not yet known which of the two prominent herbaria—Sibpur at Calcutta or Dehra Dun—will be selected as the Central National Herbarium. A botanical museum on modern lines will be established.

It is also learnt that a botanical garden will be established in each State of the Indian Union. The Punjab Government has already provided 400 acres for such a garden near the new State capital at Chandigarh. A botanical garden may be started at Junagadh for Sourashtra. The central garden will be the National Botanic Gardens at Lucknow whose Director, Dr. K. N. Kaul, represented India at the Eighth International Congress of Botany in Paris this July.

The Botanical Survey of India, unlike the Geodetic Survey, the Geological Survey and the Zoological Survey, had a chequered and sad course. It was started long after the other surveys were established. In 1885, Dr. Thistleton Dyer, Director

of Kew Gardens, submitted a scheme in consultation with the Superintendents of the Royal Botanic Garden at Calcutta and the Botanic Gardens at Saharanpur, for amalgamation of the Botanical Departments in India under a unified directorate. This scheme was approved 5 years and 13 days after its submission. On March 21, 1890, the post of the Director of the Botanical Survey of India was created and it was only in 1891 that the Survey came into being when the government botanists of Bengal, Bombay, Madras and North-West Provinces became Regional Directors of the Survey.

The glorious period of the Botanical Survey lasted but a few years. In spite of a brief and brilliant spell of activity between 1899 and 1911 when 5 plant explorations were organised, the Survey soon fell on evil days. In 1901 the Provincial grants were discontinued. In 1903 the northern circle was abolished. In 1910, the rich herbarium at Saharanpur was transferred to the Dehra Dun Forest Institute. At that time the Botanical Survey of India had two Indian assistants, one photographer and one clerk on its staff! In 1912 it was amalgamated with the Industrial (!) Section of the Indian Museum and the Office of the Reporter on Economic Products which post the great Dr. Watts had filled with great distinction. In 1913 Mr. Calder became *Ex-officio* Director of the Survey and continued till 1937. During this long period of 24 years, the Indian Botanical Survey was mainly preoccupied with the manufacture and sale of cinchona!

After 1937, the Survey just lapsed into desuetude. We congratulate the Government of India for rescuing this Institution from the limbo to which it was consigned several decades ago.

The Botanical Survey is no new conception to India. According to Dr. Janaki Ammal,* "the first Botanical Survey to be recorded in India was perhaps that of Jivaka, the physician of King Bimbisara (528 B.C.) who as a student at the University of Taxilla was asked to collect, describe, identify and mention the properties of all plants that grew within the four *yojanas* of the University Town (1 *yojana* = 9 miles)". It is therefore clear that Botany was part of the curriculum in seats of learning. The duties of an Applied Botanist have been well described in *Arthasastra* (350 B.C.). A *Vrikshayurvedajna* as the Applied Botanist was called, should learn the art of collection

* Grateful acknowledgements are due to Dr. Janaki Ammal and *Science and Culture* (1954, 19, 322-28) for much of the material on which this article is based.

of plants, the selection of seeds, the treatment of plants in health and disease (Culture and Plant Pathology), and to identify and classify them—precisely the duties envisaged for the revived Botanical Survey of India. The classification adopted by the Indian botanists was similar to that adopted by Carl Linnæus twenty centuries later, consisting of a generic name with a descriptive prefix for the species. Sir William Jones, the Botanist and great Oriental Scholar, has stated that "Linnæus himself would have adopted the system had he known the learned and ancient language of this country". But unfortunately in this country, systems and traditions become petrified very soon and instead of being maintained and improved by sustained hard work and continued research, they become mere dogmas for meek acceptance, if not for worship. The botanists of later periods seem to have given up the experimental methods and profound observational techniques practised by ancient sages and savants. As years rolled by, *Vanaspathi Sastra* appears to have been considered as the domain of charalatans, magicians and village *Vaids*, unworthy of study by scholars and students.

Indian plants and their properties, their nomenclature and classification came to be more widely known only from the sixteenth century. The Portuguese, Dutch, Danish and British scholars have made mighty contributions to the study of Indian flora and in addition have enriched it by such valuable introductions as guava, custard apple, cashew, pineapple, papaya, groundnuts, potato, tobacco, chillies, coffee, tea, cloves, cinchona, rubber, Chinese mulberry, breadfruit, sago, etc.

The first comprehensive flora of India was compiled only in the last quarter of the nineteenth century. Hooker, whose monumental work appeared in 1872 and completed in 1897, never intended his 'Flora of British India' to be more than a sort of *Prodromus* or introduction to the study of Indian flora. He has himself stated that "It is a pioneer work which besides enabling botanists to name with some accuracy (how modest!) a host of Indian plants may serve two higher purposes, (1) to facilitate the compilation of local flora and monographs of the large Indian genera, and (2) to enable the phytographer to discuss the problems of distribution of plants from the point of view of what is perhaps the *richest and is certainly the most varied botanical area on the surface of the globe and one which in a greater degree than any other contains representatives of the flora of both the Eastern and Western Hemispheres*". We feel

sad to realise that in spite of being the inheritors of such great plant wealth we should have made little contribution to this work even after a lapse of half-a-century and that instead of revising and enlarging Hooker's flora we should be content to take it as a final product.

It is hoped that, with the revival of the Survey, Hooker's expectations will be fulfilled. The Government of India have envisaged utilisation of all existing facilities in the country. They propose to encourage University and research institutes by grants to staff and students for conducting research on problems dealing with the flora of India and in collecting material for the long overdue revision of Hooker's volumes. The students may usefully undertake compilation of local floras with all local names and data regarding their uses in medicine and other arts that practitioners of indigenous medicine both Ayurvedic and Unani, may give, if suitably approached. We are also told that the Survey will search for new economic plants in unexplored regions and also introduce many from other lands. A couple of years ago there was a proposal to establish a Plant Introduction Bureau under the auspices of the Indian Council of Agricultural Research. This function may better be taken over by the Botanical Survey. Some portion of the work of the Plant Quarantine Directorate at New Delhi may also be transferred to the Survey so that there may be only one agency dealing with plant introduction and quarantine. It is also hoped that the Survey will revive the "Records of the Botanical Survey". We would suggest the issue of a quarterly bulletin in popular style on the lines of the *Kew Bulletin of Miscellaneous Information.*

AGRICULTURE IN U. S. AND ISRAEL

Sri. C. S. Seshadri, I.A.S., Sub-Division Officer and *Ex-officio* Project Executive Officer, National Extension Service Block, Tiptur, gave a very interesting and informative talk on his impressions of agriculture in U.S.A. and Israel in the auditorium of the S. J. Occupational Institute on June 21, 1954. He described the life of farmers in the highly individualistic farms of America, and in the collective and co-operative farms of Israel. What struck him most in both the countries was the hard work put in by the farmers, their wives and children. Each child in America was encouraged to work and work hard, with pay-

ment of money as reward. To instil the habit and spirit of work, parents often hired their own boys and girls. In Israel the motive for hard work was the burning patriotism of the people to build a prosperous Jewish homeland : it is work and work mainly that has made America prosperous and Israel, a viable State. In India, unfortunately, either tropical torpor or hang-over of centuries of slavery or some of our national characteristics have made us lazy, lethargic and critical. If our "spirituality" rejects money as an incentive for work, can we not at least substitute patriotism in its place. As long as we refuse to accept or act upon the gospel of the dirty hand, so long will our poverty and misery remain. Man has been provided with mouth to eat and talk. But he is also endowed with a pair of hands to work. If, for some decades, we use the former a little less and the latter a little more, all would be well with our country.

The lecture was illustrated with excellent colour pictures taken by the lecturer and was held under the joint auspices of the Central Library (extra-mural activities) of the Department of Agriculture and the State Agricultural Information Committee.

An hour's industry will do more to produce cheerfulness, suppress evil humours and retrieve your affairs than a month's moaning.—*Benjamin Franklin.*

Public affairs are only the sum total of private lives. Every weaver, every peasant, every trader must make up his mind to do his best, each in his own sphere, avoiding DECEIT and avoiding IDLENESS.—*C. Rajagopalachari.*

Work is Wealth and Service is Happiness. Nothing else is. The greatest crime in India today is IDLENESS. If we root out idleness, all our difficulties including our conflicts will gradually disappear.

PROTECTION OF FARM WOOD WORKS

By D. G. Wesley*

The farmer and farming industry have been the greatest users of wood in India. Farm structures as a class are very susceptible to decay and termite attack by reason of their general type of construction and the rough usage to which they must necessarily be subjected.

Wooden farm buildings, outhouses, cattle sheds, fences, pigsties, chicken houses, etc., require a large amount of wood and these are usually of the variety that are easily attacked by insects and fungi. Costlier woods cannot be used for this purpose due to the economic condition of the ryots. Broken down fences, sagging roofs and reclaiming walls are a common sight in our villages. The farmer is put to enormous waste of time and money in trying to keep these things in order as they are always decaying and often he is fighting a losing battle.

The durability of wood may be defined as its resistance to deterioration and destruction by the action of wood destroying fungi and insects. When abundant supplies of the durable teak, rosewood, etc., are available at a reasonable cost the problems of rapid deterioration of wood are not serious. Today with these woods extremely costly the farmer must be satisfied with woods that are structurally and mechanically suitable but are in general non-resistant to decay. The inconvenience, labour and expense of making frequent renewals in farm structures and fence lines have created a natural interest in the process whereby wood can be treated with preservatives in order to prolong its natural life.

There are many native woods that have every desirable property except the quality of withstanding decay. The art of treating wood is not difficult, nor is the expense unduly high but there is a technique that is essential, and unless the work is properly done with species that are receptive to treatment the results will not justify the efforts and the expense involved.

With farm timbers pressure methods cannot be applied and other processes suitable for local use have been devised. These are by no means so effective as those in which compressed air

* District Forest Officer, Sagar, Mysore State Forest Department.

is used. But if details of correct procedure are followed, thoroughly worthwhile results will be obtained. When properly treated some of the most perishable woods can be made to resist decay and insect attacks for periods varying between 20-30 years.

There are various preservatives which are suitable for various purposes. The most important desiderata in a wood preservative are generally considered to be the following :—

(1) It should be toxic to wood-destroying fungi, insects, etc.
(2) It should be permanent.
(3) It should be available in large quantities and be cheap.
(4) It should penetrate the wood reasonably well, *i.e.*, should not be too viscous.
(5) It should be non-poisonous to human being and animals.
(6) It should not be corrosive to metals.
(7) It should not render the wood more inflammable.

The efficient preservation of timber is dependent not so much on the actual preserving agent employed as on the method by which it is applied to the timber and the quantity used per unit of surface area or volume. It is not always possible neither is it necessary to obtain complete impregnation of the timber in the majority of the cases, and the extent of impregnation and consequent protection is governed by the conditions under which the timber is to be used. For permanent protection it is essential to obtain sufficient penetration of the preservative to ensure that at no time will unimpregnated wood be exposed by splitting, mechanical abrasion or cutting and to provide a sufficient reserve of antiseptic in the timber to allow for losses that take place owing to leaching and evaporation. An impregnation treatment is essential in all cases where long life is required for timber exposed to conditions favouring decay, *i.e.*, all timber in contact with ground, water or saturated air. For timber not in contact with ground and exposed to normal atmosphere or comparatively dry air, conditions are not so favourable for decay and a surface treatment is often sufficient. The proportionate loss of preservatives of the oil type, however, is much greater in this case than in the case of impregnation treatment ; and it is necessary to repeat a surface treatment periodically, usually about every 2 years.

Common Preservatives Used : Oil Type

1. *Coal or Wood Tar.*—This is by no means an efficient preservative as it is not very toxic and because it is very viscous which renders penetration difficult. So whenever it is used it should be used hot. It can be used for rough material like fence, posts, etc.

2. *Wood Tar Creosote and Coal Tar Creosote.*—This is the most widely used preservative. It is black or brown in colour, generally heavier than water and is obtained by distillation of coal tar or wood.

It is highly toxic to wood-destroying agencies such as fungi, insects and marine bores. It is slightly soluble in water and has a high boiling point ; and is available in large quantities at a cheap rate. Further it is easy to apply to timber and does not seriously corrode metals. On the disadvantage side it has smell, which is objected to by some, the wood treated with creosote cannot be painted satisfactorily. Creosote stains plaster work.

Water-Soluble Type

Compared with oil type the water-soluble preservatives have certain advantages as well as disadvantages. Generally they are much cheaper, easier to transport since the solid or the concentrated form is used and the majority involves very little fire risk, and they are generally odourless. The treated wood after drying can usually be satisfactorily painted with ordinary oil paints. Such preservatives, therefore, are of special value for the treatment of timbers used under conditions favourable to decay where these special properties are also of importance. On the other hand, since they are water-soluble, being applied in the form of aqueous solution they are usually more readily leached out of the wood if used in contact with the ground and are therefore not so suitable on the whole as the oil type for use under these conditions.

Zinc Chloride

It is particularly suitable for the protection of timbers out of contact with the ground which are at the same time exposed to conditions favourable to decay, *e.g.*, the roofing timbers.

Copper Sulphate

Copper sulphate is not extensively employed, probably because of its chemical action on iron. Although quite toxic to

the wood-destroying fungi it has the disadvantage of low permanency on account of its high solubility.

Wood-Preserving Processes

1. *Charring.*—The process of charring the surface of wood over a fire or torch in order to prevent decay is so old that its origion is unknown. While the degree of protection afforded is low yet it stands to reason that a layer of charcoal on the surface of fence post or other timber would protect the wood beneath from attack by fungi and insects. But owing to the fragility of the charcoal, however, it is practically impossible to maintain a continuous layer over the surface and decay can usually reach untreated wood through checks or at places where charcoal sheath has broken away. This method thus is not very effective, but may be employed where other methods cannot be.

2. *Charring and Spraying.*—Charring has been used in several processes as a preparatory step to spraying standing poles with creosote. When used in this way the treatment is intended to dry and sterilise the surface layers of the wood and to provide a thin shell of charcoal which will absorb the creosote and thus serve as a preservative reservoir. This process is definitely more effective.

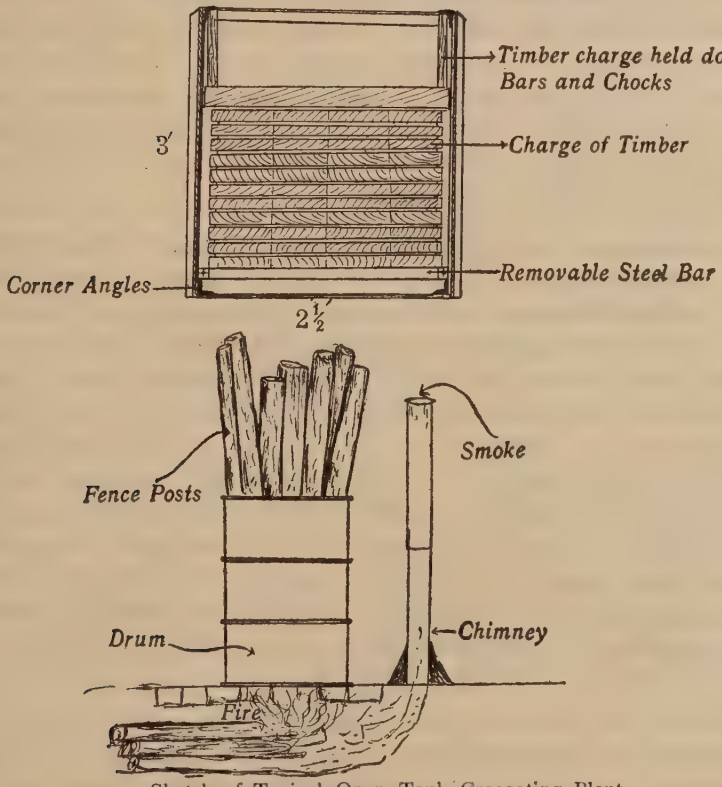
3. *Brush and Spray Treatment.*—The processes included under this heading provide for brushing or spraying preservative over the surface of the timber to be treated. Some of the liquid is drawn into the wood as the result of capillary action but the penetration is usually very slight at best.

Coal tar creosote and similar oils are the preservatives generally employed in brush and spray treatments ; but water-soluble salts are also used to some extent. In using the brush or spray methods the preservative should be flooded over the surface of timber and allowed to soak into the wood as much as possible ; it should not be brushed out thin like paint. All checks and other openings should be filled as thoroughly as possible. Two coats provide much better protection than one ; but the second coat should not be applied until the first has dried or soaked into the wood. It is considered advisable to heat preservative oils before applying them. The wood should be thoroughly air-seasoned before treatment and also warm enough to avoid any marked tendency towards thicken-

ing or congealing of the oil. It is useless to brush or spray oils upon wood that is green or has recently been wet.

While brushing and spraying are not to be recommended for use when more thorough methods are available, these methods of applying preservatives are used rather extensively because of their marked simplicity and low cost. The required equipment is portable, so that treatment can be given on the job, as well as at concentration points, and the preservative is easily and quickly applied. Furthermore the methods are applicable to single pieces and small lots of timber as well as to large-scale operations; the amount of preservative required for a given job may be so gauged that little or none of it need be left over.

DIAGRAMS OF EQUIPMENT REQUIRED



Sketch of Typical Open Tank Creosoting Plant
Butt Treatment for Fence Posts.

Dipping.—Dipping the timber in a bath of the preservative is better than either brushing or spraying and results in the effective coating of all surfaces of the timber.

It is somewhat more expensive than brushing or spraying since it requires more equipment and larger quantities of preservative and is not so well adopted to treating small lots of timber especially on the job. However, it has definite advantages in that it ensures a more adequate penetration of checks and other openings and involves a larger contact between the wood and the preservative. The same general precautions should be observed as in brushing or spraying. For best results the preservatives should be heated and the wood well seasoned.

Steeping.—This process consists in submerging wood in a tank of the preservative ; usually a water solution and allowing it to soak for several days ; or even weeks. The preservative solution is normally allowed to remain at atmospheric temperature although more rapid penetration would be obtained if it were heated. An old rule of the thumb for determining the steeping period for seasoned wood was to allow a day for each inch of thickness of the material with an extra day added for good measure. However there is apparently no logical basis for such a rule and a soaking period of a week to 10 days is ordinarily considered desirable.

When steeping green timber practically none of the water of the solution enters the wood ; and the concentration decreases as the chemical is absorbed. To provide for this as well as to promote rapid diffusion it is desirable to use higher strengths (such as 10 per cent.) than are employed for seasoned timber. Better penetrations are obtained in green than in seasoned wood, especially if the former is close piled and allowed to remain damp after being removed from the steeping vat. The wood should be piled in the steeping tank in such a way that the preservative can reach all surfaces. Provision must be made against floating of timber. This can be done either by piling the material in the tank and anchoring it down before admitting the preservative or by sinking the timber in the preservative by means of weights.

Open Tank Treatment.—In order to obtain effective impregnation by steeping the timber must be allowed to remain in the liquid for long periods often extending to 2 weeks. Similar, if not better results can be obtained in 24 hours by what is known as the open tank hot and cold process.

Although the apparatus used consists of an open tank, the impregnation is effected by means of pressure just as if a force

pump had been used ; only difference being that it is the pressure of the atmosphere which forces the liquid in to the wood. A piece of wood in an air-dry condition will contain minute air spaces totally to about 50 per cent. of its volume. If this wood is immersed in a liquid which is then treated the air in the wood expands and a certain amount is driven out and can be seen escaping as bubbles through the liquid. On cooling the remaining air contracts forming a partial vacuum, and the liquid is gradually drawn in to the timber. In other words, during cooling the atmospheric pressure is greater than the air pressure inside the minute spaces in the timber.

Thus absorption takes place during the cooling period. The greater the difference between the maximum and minimum temperatures the greater the difference in the pressure of the air inside and outside the timber, and consequently the greater the absorption.

The general method followed is :—

The timber is immersed in cold creosote which is then gradually treated up to 180-200° F., and maintained at this temperature for about 1 or 2 hours ; depending on the size and species. The creosote is then allowed to cool, care being taken that the timber is kept completely submerged during the cooling period ; and if necessary more preservative added to maintain the level. The timber is then removed and allowed to drain after which it is ready for use. The process can be accelerated by having two tanks, one containing hot creosote and the other cold creosote.

For the treatment of fence posts, efficient results can be obtained by what is known as "Butt treatment". In this case the lower end only of the post is given an open tank treatment and the upper end either brushed with or dipped in creosote. All the apparatus required consists of an old iron drum which can be heated by fire underneath. The posts are placed upright in the drum, the level of the creosote being just above the point on the posts that would be at ground level when erected. It is essential that the drum should be sound and that it be used with care, so that leaks do not develop causing risk of fire.

Modern industrial developments have set up increasingly exacting service requirements for many timber products with the result that the burden of supplying the demands of the

consumers has become more and more concentrated on special kinds and grades of wood. The farmer is faced with the problem of using the cheaper kinds of timbers as the favoured types are all very costly. These cheaper woods are all usually easily attacked and destroyed by insects and fungi. Hence the treatment of woods comes to be of paramount importance. The abovementioned methods of treating wood while they are not the best, yet are those that are easily employed by any agriculturist.

The primary objective of the preservative treatment of wood is to increase the life of the material in use thus decreasing the ultimate cost of the product and avoiding the need of frequent replacements in permanent and semipermanent construction. The methods described are the simplest possible and can be adopted by any farmer to protect his farm wood works.

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We cannot live without trees. They serve us faithfully in many forms and fashions. A chair was once a tree ; the bed, the table and the pen, the racquet and the oar and many other things were once the forest tree with roots in God's good soil and branches dancing in the breeze. I wonder if the table ever dreams of better days remembering its leisured life when it could stand and gaze at star and cloud. A kingly oak superb in height and girth that sheltered men and birds and beasts and towered above the earth ; I wonder if it has a secret kinship with the rain and thrilling to its music lives a thousand dawns again.—Patience Strong, *Daily Mirror,* 6-8-1936.

FRUIT TREES IN THE KITCHEN GARDEN

1. Bananas

By Dr. T. M. Paul*

(Received on 26th May 1954)

Banana or more commonly called plantain, is a well known and probably the cheapest of the largely consumed fruits of the tropical and sub-tropical regions. Where the soil and climatic conditions are favourable, large banana plantations are possible and they do exist particularly around towns and cities. Banana is also one of the fruits that could be grown in any kitchen garden or backyards of houses without much difficulty. It is a high-yielding fruit, each plant giving on an average more than 100 fruits and the fruit is rich in food value containing 1·3 per cent. protein, over 36·0 per cent. carbohydrates, minerals and several of the vitamins. Besides the fruit, the other parts of the plant like the leaves, are useful in some way or the other and hence it is a plant of great utility in the kitchen garden.

While large-scale organised planting of bananas need fairly elaborate preparation of the ground by ploughing, etc., such preparations are not necessary for planting a few plants in the kitchen garden, nor is it practicable very often. Any vacant corner in the kitchen garden may be planted with bananas. Three feet square pits may be dug to a depth of 2-3′ at 6-8′ distance from each other and half filled with a mixture of cattle-yard manure and kitchen waste including wood ash from the kitchen. While filling the pit over each layer of manure and kitchen waste mixture, put one layer of soil by breaking the top sides of the pit. This will not only widen the pit but also fill it with the top soil rich in humus, etc. Any stones, etc., found while filling the pit may be removed. It is better to get the pits ready before the monsoon sets in.

The planting of the banana may be done immediately after the beginning of the monsoon. Healthy, pointed sword-suckers are the best to propagate bananas. Suckers of mother-plants with mature bunches, or bunches removed, are supposed to be

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the most suitable. These are separated carefully from the mother-plant by digging round it. So also, the roots and the head of the sucker may be pruned off about a foot or more above the rhizome. Plant the sucker in the half-filled pit and cover it with earth which should be well pressed down round the sucker. Gradually fill the pit with intermittent layers of soil and manure as the plant grows. Till the pit is filled competely, a ridge of soil may be kept round the pit so that rain-water does not enter the pit. If banana is planted on top of the pit, its suckers need transplantation in future as they will come almost on top of the ground and if allowed to grow fully may fall off in breeze. When the suckers are planted about 1½′ inside the pit, it will take a long time for the new suckers to come to the ground level, and all that time strong and vigorous plants are obtained without the trouble of transplanting. This is a great consideration in a kitchen garden where most of the work in the garden is done by the people of the household and no paid labour is employed.

Immediately after planting, the banana is watered well. Subsequently, it may be watered once a week or once a fortnight, depending upon the season and the rainfall. Remove the weeds from the inter-spaces once a fortnight and keep it clean and mulched properly. This is particularly important in a kitchen garden where there is a tendency for soil to get set due to frequent watering and people walking about. Manure, including kitchen waste, may be applied as often as they are available or once in 2 months. The plant may also be earthed up occasionally for support for the growing plant.

Banana flowers in about 12 months after planting and the fruit will be ready in another 6 months. When a certain number of the whorls have set, there is no more fruit setting and the inflorescence may then be cut off 3-4″ below the last whorl of bananas. As the bunch grows, the plant may be staked, as otherwise it may fall off in heavy breeze. This is very important in the case of plants which grow tall, but in the case of short stalky varieties it may be safer but not absolutely necessary in a kitchen garden. When the fruit is half mature, the bunch is covered by the leaves from the tree either dry or green. This improves the colour of the bananas as also gives it protection from the hot sun, birds, animals, etc.

When the bunch is half grown two suckers may be allowed to grow from the mother-plant. These form the mother-plants

for the next year. For the third year each plant may be allowed only one sucker, as otherwise the garden will get overcrowded. By this time the sucker would have reached the top of the pit and it is time to transplant the subsequent suckers in fresh pits dug in between the old pits. It will be ideal to transplant the second daughter-sucker itself, if place and facilities permit in the kitchen garden, but a fairly good third crop can be obtained in a kitchen garden, if it is not very crowded.

Banana should be harvested only when fully matured. Mature fruits will be round without any ridges in certain varieties and also the pistil attached to the apex of the fruits will be dry. It is always better to wait till a few fruits on the top whorl ripen. The bunch may be cut off at this stage, or one or two whorls may be removed from the bunch and ripened by smoking in an earthen pot as otherwise the entire bunch will get ripe at the same time and it will be a waste in a small or even a medium size family. In the case of tall plants, it may not be possible to reach the bunch easily when the plants itself may be partially cut from the underside (side to which the bunch stands) as high as one can reach and allowed to fall with the bunch hanging. The bunch may then be cut off and later on, the mother-plant itself is removed by cutting it above the ground level.

After the removal of the mother-plant, the daughter-suckers are pruned by cutting off the top in a slanting manner. The interspaces are mulched for aeration and the plants are earthed up for support. Ordinary compost from kitchen waste and cattleyard manure or any other manure is then applied and plants are watered occasionally as in the case of the mother-plant. The same procedure may be adopted in the case of the daughter-suckers also.

The author planted seven plantain suckers in his kitchen garden at 5, Curley Street, Richmond Town, Bangalore, in the middle of 1949. The suckers belonged to some ordinary country variety. The pits were prepared as detailed above and filled with kitchen waste, compound sweepings, poultry-run sweepings and cattleyard manure. From the end of 1950, the plants started yielding, providing the family a frequent supply of plantains, which happened to be soft, very sweet and of a good flavour. The plantain bunches in the first year from mother-plant were all moderately big—each carrying on an average about 150 fruits. Each fruit was about 4 oz.—fruits on the first

whorl always weighing as much as 6 oz. generally and sometimes even more. Plate I shows the author carrying a bunch from a first daughter-plant. This bunch carried 164 fruits and the weight of the whole bunch was about 50 lb. The first whorl carried 20 fruits. Plate II shows a corner of the author's garden with some first daughter-suckers in fruit. The second daughter-plants have also given equally good bunches, from the same spot (Plate III). Plate IV shows a bunch obtained from the second daughter-plant from the same spot. It carried 187 fruits weighing 60 lb. in all. The first whorl carried 25 fruits, each weighing about 6 oz.—really a record !

The extremely good performance of the banana plants in the above photographs is attributed to proper manuring and regular watering. Due to the lack of underground drainage in the author's house, water coming from the bath room and the kitchen was being collected in a cesspool which had to be emptied morning and evening. This water was invariably poured for the banana plants throughout the year, as the Municipal authorities objected to pouring it in the storm water drain by the roadside. In fact, these plants were planted only to make use of this water as it was found to be injurious to crotons and other small plants.

Even in places where such favourable conditions as narrated above do not exist, a fairly good yield of bananas can be obtained. This will, besides contributing to the grow more food efforts, provide some fruit to the middle class families who cannot possibly afford to buy fruits in these days of high cost of living. The stem and the inflorescence of the banana plant could be used for curry purposes while the leaves and the fibre could be used for packing purposes. Many people prefer taking their meals on plantain leaves. Being a multi-purpose fruit tree, the banana rightly deserves an important place in any kitchen garden.

FIG. 1. The author carrying a bunch from a 2nd year banana plant

FIG. 2. A corner of the author's garden with two 2nd year banana plants in fruit.

FIG. 3. 3rd year banana plants from the same spot in fruit

FIG. 4. The author holding a 3rd year bunch of bananas

GRAPES ARE NOT SOUR

By M. L. N. Iyengar*

AND

M. R. Anandaramiah & M. Dwarakanath Sharma§

Grapes are certainly not sour for Sri. M. T. Joseph Tharakkan (pronounced Tharagan) of Tharakkan Farm, Kengeri, a few miles south of Bangalore. His vineyard of 12 acres with 1,850 plants has, in May 1954, bore an excellent off-season crop of grapes which he estimates at least at 1,200 md. but may well reach 1,500 md. At a conservative rate of Rs. 25 per md., he may expect to get at least Rs. 30,000 this season.

It is quite a grand achievement for a vineyard which is only just 16 months old.

The story behind this achievement is fascinating. Sri. Tharakkan comes from a respectable family of Malabar Christians with traditions of planting and agriculture in their blood. Tharakkan is still young and in his early forties but he has already to his credit the establishment of a large cardamom plantation and a small cocoanut plantation in his native State. It is said that his planting of 180 acres of cardmom is the cheapest in those areas for nearly three decades but that is a different story. So Sri. Tharakkan's early adventures lay, therefore, in a different field far removed from grapes and vineyards.

It was curiosity that led Sri. Tharakkan to grapes. His nephew, Sri. George Thaliath had a small vineyard at Tenkasi where Sri. Tharakkan used to spend his spare time. He was watching with great concentration and fascination how Sri. Thaliath was propagating and the great care with which he tended the plants. When Sri. Tharakkan asked his nephew to let him into the secrets of vine culture, he would be jocularly told to keep off the vineyard as it was Sri. Thaliath's special secret but later he would be allowed to see everything.

It was at Tenkasi that Sri. Tharakkan got the idea of having a vineyard of his own and as he says, once you get the

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idea, you must run and keep on running after it. He did and is still doing so.

He owned a small coir factory which, on account of Communist trouble, he had to close. He had some cash in his hand and was on the lookout for fresh adventures and pastures. Some time in May 1952 he came to Madras to purchase a radio and look into the affairs of a film company in which he has some interests. Suddenly he decided to take the train to Bangalore. He had heard that Bangalore grew grapes and he wanted to see for himself if he could run his idea to the earth. He quietly watched the Bangalore market and visited Government Farms and private vineyards ; he was new to the place and had no one to guide him. But he got scent and like a hound he went after it. It led him to Kengeri where he saw some vineyards and plants. He instinctively felt that this area would suit him, made local enquiries, learnt that a part of the old Todhunter estate, about 25 acres was up for sale and walked into what became later Tharakkan Farm but what was then a piece of inhospitable and unpromising land overrun with scrub jungle. His eyes fell on a huge pit which was evidently dug up for building the nearby shed. He saw the soil profile—red loam alternating with layers of pebbles and gravel. He had read that red "pebbly" soils are ideal for grapes and he at last found in the profile what he was looking for. The jack fruits planted by the previous owners were in a neglected state but their healthy dark and luxurious foliage convinced Sri. Tharakkan that the soil was good. If the jack did not yield fruits it would at last serve as a wind brake, so argued Tharakkan when questioned about their utility—particularly in a monkey-infested area where it would afford only perches and sanctuary for them. The land slopes steeply to the west and dips into a small rivulet with a grand fine name—*Vrishabavathi* but which is nothing else than the effluent from the Bangalore sewerage. Tharakkan quietly noted that in the estate well, a few feet away from the stream, water stood to a depth of 4 to 5′ even in midsummer. He then decided that this was the place he was looking for—his *El Dorado*. He soon ferreted out the owner, heard his price and in his anxiety paid a little more than what was demanded—Rs. 17,500 for a 25-acre block with a well, a small shed, a broken down motor in a pumphouse, with a hundred and odd pomegranates, a few jack trees and some mangoes. He considered it a bargain not for what it contained then but for its latent possibilities. He had

to pay cash on the spot on the very day ; he went to Madras, got back in the plane and closed the deal. The Tharakkan Farm was born.

He came down in June 1952, was hospitably offered lodging by his neighbour Sri. Ranjoth Singh. He embarked on his adventures and labours which have not yet ended. He at last realised his dream of a vineyard.

The property was unprotected and was a prey to all types of predators—biped, quadruped and winged. On the first day, when he stepped on his land, he saw a procession of monkeys with little jack fruits in their mouths and arms, unconcerned, bold and menacing. Little did they realise that their end was near and they did not then recognise in Sri. Tharakkan their future destroyer.

Soon after he took over, he planted a live fence, *Kalli*—milk bush, *Cynadenium grantii*. He got 3,000 six-inch posts, at Rs. 30 per thousand, purchased 4,000 cuttings of the Bangalore Blue variety, Thompson Seedless, Bombay Bukhari Nagoor, Red Kabul and Egita, from other areas and from his nephew. For a man who had no previous experience, to have had a large percentage of success in the nursery is quite an achievement. While the plants were growing in the nursery Sri. Tharakkan gave 3 ploughings with the iron plough and dug pits $3' \times 3' \times 3'$, 15 apart on the square system. He purchased large quantities of cattle manure from the military dairy at Hebbal,* and he made a bargain purchase of blood and slaughter house offal. He collected dried leaves, etc., mixed them all up with red earth and prepared a huge mound (*gudda*). In 3 to 4 months the whole heap matured into soft powdery manure "like butter" and "was eaten greedily by dogs and crows" (in Tharakkan's words).

He planted his vineyard in January 1953, only 7 months after he took it over (he considers January as a good month for planting). At planting, he applied to each pit a mixture of leaves and manure from the heap : he tended the plants care-

* Sri. Tharakkan was rather proud of this purchase. He said that what he got from the dairy was not merely manure but also half-digested Government money. Not all the concentrated feed purchased at Government cost and fed to the animals was used up in milk production, a good proportion of the nutrients in the feed passed down to the dung and these nutrients in the manure really meant half-digested Government property.

fully, watered it once in 3 days, keeping down weeds and grass. Just when the plants were establishing, kindly neighbours and passing well-wishers posed a problem to Sri. Tharakkan. The *Vrishabavathi,* as mentioned earlier, is a stream fed by Bangalore sewage, Binny Mill effluents and possibly, tannery wastes from the Mysore Chrome Tannery & Co. on Mysore Road. Sri. Tharakkan was told that with such fouling the water would be saltish. He was assured that all his plants would die ; he should have been a wee bit scared ; anybody who had invested his fortune would be. But surprisingly, Sri. Tharakkan did not react in the manner expected. He is a very observant man and does not miss much. He saw some fish in the stream during the hottest part of the year when salt and sewage concentration in the water would be highest. He also saw some "water weeds with blue flowers" (water hyacinth). They were the same as those found in the backwaters of his home State. These weeds would decay whenever sea-water flowed back into the backwaters. He knew therefore that such weeds cannot thrive in salt-water. The presence of fish and water weeds told him that the water was not saltish, and that it would be suitable for his vines. Suitable they did prove.

In the meantime Sri. Tharakkan got the pump into commission. This is set fairly deep in the pump house to facilitate suction even during summer when the water level goes down. The water is pumped on to the highest point in the east of the estate through pipes and the fields are irrigated by gravity flow from this point.

The vines were watered once in three days in the hot weather and whenever required after the rains. They made very rapid growth in the spring and summer. The next fight was with whiteants. He fought them with Gammexane ; all the same, he lost 300 plants. He kept on removing the grass from the fields so that the vines may get a good start. In June, mildew made its appearance but happily little damage was done. He fed the plants with groundnut cake mixed with the mound compost once in 15 to 20 days.

While the plants were growing, Sri. Tharakkan bought wires—11 tons of wire at Rs. 950 a ton and strung them over stone posts. He bought 2,000 of these pillars from a nearby quarry at Rs. 2 per pillar. Again he was offered gratuitous advice and assurance that the iron wires would get hot during summer and burn the tender vines trained on them. Believing

them he tried thin coir ropes but found them useless. So he changed over to wires and found them quite appropriate. The jeremiahs were again proved wrong.

To keep the wires taut on the pillars after they were covered over with vines and fruits posed a small problem to Sri. Tharakkan. By that time he had exhausted all his resources and he was not in a position to invest further on stone posts to secure the guy wires. He had seen in Bangalore electric poles kept taut by wires secured to the base. He adopted the same principle and by tying the guy wire ends round small boulders which abound in the estate and sinking them 2 to 3' deep in the soil he was able to keep the whole *pandal* lifted up and taut.

He forestalled grape diseases by methodical and regular protective sprays and dusts ; for this purpose he invested Rs. 600 on fungicides.

By such wise measures he got the vineyard going and flourishing. But he had to contend with a big menace—the depredations of the monkey ; monkeys are sacred and although he had no sentimental objections, he was afraid of incurring the wrath of neighbours and interfering busy bodies by killing them. If he did not kill them, all his investment, efforts and ambitions would go west.

So Sri. Tharakkan embarked on his plan on the sly. The first monkey that fell to his gun—he is a good shot, was apparently an accident ; he had aimed at a bird, but unfortunately hit a monkey, so he would explain if asked. He took the carcass to a remote hillock. His three dogs and their friends greedily ate the flesh and no incriminating evidence was left. He then moved the problem with his neighbouring villagers with an air of innocence. He learnt that although the villagers knew how destructive monkeys were they would not be a party to their destruction as such an act would curse them and their progeny to eternal childlessness. Had they any objection if Sri. Tharakkan killed a few ? They had none. So he shot another monkey, this time a little more publicly. There was no reaction to this overt act. He got into stride and killed quite a good number. Soon the word got round among the monkey packs and Tharakkan Farm has since then remained free from these marauders. The neighbours who envy Sri. Tharakkan his freedom from crows and monkeys are requesting him to don the mantle of a deliverer and save them too. They even

bring ammunition for him. Sri. Tharakkan has a fine sense of humour. He asked them how they could be a party to this act which would lead to "childlessness". Their reply was "the curse is on the man who actually kills and not on those who abet in the destruction". Sri. Tharakkan laughed at this joke and has helped to rid the area of monkeys.

By January 1954, the vineyard had established to his satisfaction. But by then his money had run out. He wanted to rehabilitate himself, at least to the extent of providing himself with some cash for his day-to-day farm expenditure. Sixteen men and 30 women are working on the estate and he had to pay their weekly wages. More than that, he had wanted to get his results in 16 months. Sri. Tharakkan seems to play far high stakes. Not being deterred by the locking up of his money, not being satisfied with his bold venture of establishing a vineyard in an unknown place hundreds of miles away from his home ; Sri. Tharakkan wanted to go in for an off-season crop in the very first year of harvest. He started pruning between January 30 and February 15, 1954. He had no experience of vine culture, much less of the art of pruning. But Sri. Tharakkan is that very rare person who respects text-books and practises what he reads. Every day between 4 a.m. and 6 a.m. he would read the books—4 to 6 standard works on viticulture, go out and practise pruning. He pruned by stages so that he may get his bunches in orderly succession. A fortnight before pruning he gave a general dressing of heap manure at the rate of 5 to 7 baskets to each plant. The basins round each plant were widened and regularly watered. The grass growth was not, however, removed when the vines were in flowers as that would affect the yield by damaging surface roots.

The vines flowered in February-March. The bunches began to develop and when we visited the place in the third week of May, the whole vineyard sagged with the weight of grapes. On an average each plant carried more than 120 bunches and each bunch weighed about ½ seer. Sri. Tharakkan conseratively underestimated the weight of his bunches at 2/5th of a seer. In one area he expected an yield of 1¼ md. per plant and in the other which was not manured enough on account of exhaustion of working capital, ¾ md. per plant. Varietywise he expected to gather 1½, 2 and 3 md. per plant from Thompson Seedless, Kabul Red and Egita respectively. His total estimate from his vineyards was 1,200 md. As the fruits were gathered

FIGS. 1–8: 1. General view of Tharakkan Farm; 2. Soil profile showing gravelly texture; 3. Farm Well. Behind it may be seen Vrishabavathi rivulet; 4. Bunches of grapes; 5. A close-up of bunches; 6. Sri. Joseph Tharakkan; 7. Bunches of grapes and a bunch of children; 8. Tharakkan Farm House.

—Photo by P. Raghuram

in an off-season, he could expect to sell his produce at least at Rs. 20 per md. At the time of our visit the ruling rates were Rs. 20 at Bangalore, Rs. 37 at Madras and Rs. 40 at Coimbatore.

Sri. Tharakkan has invested roughly Rs. 5,000 per acre till now excluding the land value and even if the yield is Rs. 24,000 (1,200 md. at Rs. 20 per md.) or Rs. 2,000 per acre he will have much to be congratulated.

Sri. Tharakkan expects to rest the plants for about a month after the present crop is sold out and get it into bearing again by the end of the year. He has plans to plant sapotas and mangoes on the other portions of the estate. He intends to go in for plantains too—the *Nendran* variety so common and popular in his native Malabar chiefly for providing himself with enough fibre for use in the vineyard. We have no doubt he will make a success of these plantings also. He has the money, the brains, the enthusiasm and concentration required for a farming venture of this kind.

By developing the Tharakkan Farm he has shown his neighbours and others how adventurous farming can be and with enthusiasm, single-minded application to work, how successful it can turn out. When asked what was the secret of his success he replied, "For success in any enterprise, particularly plantation farming, what we require is *Brains and intense concentration*".

Honest work is the fundamental law of progress
Happiness is simply work's greatest by-product
Go the last mile and enjoy it.—*Konrad Adenauer.*

SUCCESS slips from you like sand through the fingers, like water through a leaky pail, unless success is held tight by hard work, day by day, night by night, year in and year out. Every one who is not looking forward to going to seed looks forward to working harder and harder and more fruitfully as long as he lasts.—Stuart Sherman in *Shaping Men and Women.*

SUGARCANE IN MYSORE—AN ACCOUNT OF RECENT WORK ON VARIETAL IMPROVEMENT

By B. Venkoba Rao and K. Lakshminarayana Bhatta*

Sugarcane occupies an important place in the agricultural economy of Mysore State. It is cultivated, usually in rotation with paddy, in all parts of the State, where facilities are available for irrigation during the summer months. The annual acreage fluctuates between 45,000-50,000 acres, and roughly one-fourth of the total crop is utilised for the manufacture of factory white sugar and the rest mainly for conversion into jaggery.

Until the early twenties of this country, the only varieties under cultivation were Pattapatti, Rasadali and 'Cheni'. Of these, Pattapatti and Rasadali were more popular. Both these varieties are soft, juicy, having a low fibre content and were quite suited to the wooden mills then in vogue. Though the quality of jaggery produced was very good, these varieties lacked vigour and yields were low, an yield of more than 20-25 tons per acre being exceptional. The first attempt to improve the varietal position was made through the introduction of vigorous exotic types from Java and the West Indies. Though most of the available types were introduced, only Red Mauritius became established in cultivation. It is even now cultivated in the interior of the malnad to a limited extent though of late it is being replaced by H.M. 320 and other improved varieties.

Sugarcane breeding was started in Mysore concurrently with similar work at Coimbatore. The late Dr. V. K. Badami made a collection in 1913, of all available cane varieties from India, Java and the West Indies. At first, seedlings were raised from open fertilised fluff from exotic varieties of known merit and selections made from them. One of the earliest successes was H.M. 320, a thick juicy cane derived from Red Mauritius. It spread rapidly in all parts of the State and made the starting of a large factory for the manufacture of white sugar at Mandya possible. With the object of evolving high-yielding canes of

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quality, regular hybridisation work was undertaken in later years, and a large number of crosses were affected every year, and several thousand seedlings were raised each year and studied. An attempt to induce bud mutations by irradiation with X-rays was also made, but while this produced interesting mutations, the new types obtained were not of much economic importance. With the grant of a subsidy by the I.C.A.R. in 1933, sugarcane breeding work was intensified, the emphasis being on the evolution of thick canes, suited to tropical conditions. Concurrently with evolution of new varieties in Mysore, varieties bred at Coimbatore were also obtained and tested under local conditions. In this paper, an account is given of the varietal trials carried out in the State during 1939-52 in which both Mysore and Coimbatore canes were included.

The varietal experiments were carried out mainly at V. C. Farm, Mandya, and Babbur Farm, Hiriyur, representing two major sugarcane regions of the State served by river channels. A few of them were carried out also at Hebbal Farm, representing the tank-fed area of the State.

Experimental Procedure

The field experiments were carried out according to standard designs, comprising mostly the Latin square, randomised blocks and quasi-factorial designs. Varietal differences were judged at 5 per cent. significance for cane yields. In every case, both sugar per acre and cane per acre were computed, although for judging significant differences, only cane yields are used. C.C.S. values were computed according to a formula suggested by the Director, Indian Institute of Sugar Technology, Kanpur.

The crop in each case was raised under standard conditions of irrigation and manuring and cultivation recommended by the Agricultural Department. The maturity of the crop was followed by analysis of samples from the tenth month onwards and the crop harvested when it was fully ripe.

For the sake of convenience, the experiments have been considered under the following groups.

(1) Field trials with H.M. varieties.
(2) Field trials with I.C. varieties.
(3) Field trials with recent Mysore and Coimbatore varieties.

1. Field Trials with H.M. (Hebbal Mysore) Varieties

This series of trial was started in 1939-40 and repeated over a number of seasons at all the three farms. As a result of breeding and selection over a number of years, about 45 promising H.M. selections had become available for critical study and final selection. About this period, Co. 419 was released from Coimbatore and this was also included as one of the varieties to be tested. These varieties, 49, in all, including the then standard variety H.M. 320, were compared on a quasi-factorial design at V. C. Farm. The best 16 varieties from this trial were compared again in 1941-42 using a similar design. The yield of cane and sugar per acre together with critical difference at 5 per cent. level for judging significance, of those 16 varieties in the two trials are given below :

Variety	Yield in tons per acre				Average	
	1939–40		1941–42			
	Cane	Sugar	Cane	Sugar	Cane	Sugar
H.M. 647 ..	41·5	4·09	52·5	5·87	47·0	4·98
H.M. 657 ..	45·5	5·09	46·8	5·27	46·60	5·18
H.M. 653 ..	40·1	4·19	50·4	5·71	45·25	4·95
H.M. 661 ..	40·2	5·23	46·6	5·45	43·4	5·34
Co. 419 ..	33·2	4·35	50·09	5·92	42·05	5·50
H.M. 651 ..	39·1	4·66	43·8	4·70	41·45	4·68
H.M. 654 ..	36·10	4·27	46·6	5·20	41·35	4·74
H.M. 659 ..	36·1	4·39	40·6	5·14	38·35	4·74
Co. 290 ..	36·3	4·37	40·1	4·41	38·20	4·39
H.M. 655 ..	39·7	4·52	34·4	3·76	37·05	4·14
H.M. 656 ..	37·0	4·69	34·2	4·11	35·6	4·40
H.M. 645 ..	27·2	3·76	43·8	5·15	35·5	4·46
H.M. 644 ..	35·9	3·71	34·2	3·46	35·05	3·58
H.M. 660 ..	37·2	3·58	32·5	3·88	34·85	3·73
H.M. 606 ..	34·1	3·41	30·2	3·48	32·15	3·49
H.M. 320 ..	32·3	4·26	18·1	2·19	25·2	3·22
Variance Ratio (F) ..	..	4·17	2·8	..	..	..
F (5%) ..	..	1·82	2·09	..	..	..

Date of start of experiment : 25–2–1939 ; 1–3–1941.
Date of completion : 30–3–1940 ; 26–5–1942.

The varietal differences in both cases were significant. Taking the average yield of cane and sugar from the two trials, it is seen that varieties, H.M. 661, Co. 419, H.M. 647, H.M. 653 and H.M. 657 are superior to the rest. While the last three of these, *viz.*, H.M. 647, H.M. 653 and H.M. 657 have given slightly higher yields of cane than H.M. 661 and Co. 419, the

latter are superior on the basis of sugar per acre (C.C.S.) produced.

At Babbur Farm, three field trials with several H.M. varieties were carried out, using Co. 290 as the standard for comparison. From these trials again H.M. varieties, H.M. 647, H.M. 661 and H.M. 645 were found to be superior to all other varieties compared. For a final evaluation of their relative performance, these three varieties, together with Co. 419 were compared with Co. 290 over three further seasons at Babbur Farm. A 5 × 5′ Latin square design, with net plot size of 1/40 acre was employed. The cane and sugar yields obtained are tabulated below :

Yield of cane and sugar in tons per acre

Variety	1948–49		1949–50		1950–51		Average	
	Cane	C.C.S.	Cane	C.C.S.	Cane	C C.S.	Cane	C.C.S.
Co. 290 ..	19·65	2·73	17·94	2·32	17·04	2·08	18·21	2·38
Co. 419 ..	25·23	3·23	16·54	2·29	16·36	2·16	19·38	2·56
H.M. 661 ..	22·89	2·91	20·00	2·70	20·12	2·75	21·00	2·79
H.M. 645 ..	26·19	3·66	17·37	2·23	22·45	3·27	22·00	3·05
H.M. 647 ..	14·35	1·85	13·66	1·81	18·00	2·27	15·37	1·98
Variance ratio (F) ..	8·70	..	2·90	..	1·41	..	..	..
F(5%) ..	3·026	..	3·300	..	3·01	..	..	..
Critical difference ..	5·01 tons	..	..	..	..	..	..	..

The varietal differences as judged by cane yields were significant only during the season on 1948-49, but even during this season, the differences in yield between Co. 419, H.M. 661 and H.M. 645 were not significant. Taking the average of three years, the varieties Co. 419, H.M. 661 and H.M. 645 are superior to the control (Co. 290) and H.M. 647. In point of sugar per acre H.M. 645 excels all the others.

Several H.M. varieties were also compared under Hebbal Farm conditions in two trials using H.M. 320 as standard for comparison. In each trial, 16 varieties were included. A quasi-factorial design was employed in each case. The cane yields

of 12 varieties, which were common to both the trials are given below :

Yield in tons per acre (cane)

Variety	1941–1942	1943–1944	Average
H.M. 320 ..	43·56	61·51	52·53
Co. 419 ..	59·93	67·92	63·92
H.M. 661 ..	60·99	59·49	60·24
H.M. 629 ..	49·83	66·79	58·31
H.M. 609 ..	54·17	58·89	56·53
H.M. 654 ..	51·49	52·75	52·12
H.M. 647 ..	56·93	44·53	50·73
H.M. 627 ..	52·46	62·35	57·40
H.M. 639 ..	44·49	57·39	50·94
H.M. 658 ..	44·53	55·50	50·01
H.M. 662 ..	46·97	50·74	48·85
H.M. 617 ..	45·50	50·29	47·89
C.D. 5% ..	16·46	13·91	..

In both the trials, the yield per acre is quite high and the difference between the several varieties is not wide. Nevertheless, the varieties Co. 419, H.M. 661 and H.M. 647 have here again shown a good performance, the first two being definitely superior to the standard H.M. 320.

It is thus seen that taking the results of all the trials at the various stations, the varieties Co. 419, H.M. 661 and H.M. 647 are outstandingly good and H.M. 645 is specially so at Babbur Farm. These varieties were grown subsequently in small plots in all representative localities of the State, on subvention farms on cultivators' fields, under Departmental guidance. H.M. 661 and Co. 419 were found to do well in all places. H.M. 645 has been found to be specially suited to *Cheni* areas. H.M. 647 also did well in most of the localities tested. On the basis of these results, which became available by 1943-44, these varieties were recommended for cultivation. Co. 419, which is specially suited as an *Adsali* cane was adopted by the Mandya Sugar Factory, where the planting season is from June to November. H.M. 661 which is a medium thick cane with vigorous habit and profuse tillering, is well adopted for cultivation in unfavourable situations, *viz.*, drought condition, poor soils, etc., and is getting established in Mysore and Bangalore Districts. H.M. 645 has become firmly established in the *Cheni* area—particularly in Hassan District. H.M. 647 is not being advocated on a wide scale as it has been found to grow pithy, although in other respects it is one of our best varieties.

2. Trials with I.C. (Irwin Canal) Varieties

Mysore varieties evolved subsequent to 1933 were named I.C. (Irwin Canal) varieties, in token of the fact that the I.C.* Farm became the main testing and research station for sugarcane. Based on the results of several preliminary field trials, the following I.C. varieties, most of them derived from P.O.J. 2878, became available for critical and final evaluation by 1946.

I.C. 8, I.C. 11, I.C. 25, I.C. 26, I.C. 29, I.C. 31, I.C. 36, I.C. 37, I.C. 39, I.C. 136, I.C. 137 and I.C. 195.

Similar field trials with varieties released from Coimbatore resulted in the selection of Co. 417, and Co. 421 at V.C. Farm, and Co.421 and Co.423 at Babbur Farm. These I.C. varieties and Co. varieties, together with such new Mysore varieties as were available, were included in a series of trials at both the farms.

In the first series of these trials at V.C. Farm, 6 I.C. varieties, I.C. Nos. 11, 25, 36, 136, 137 and 195 were compared with H.M. 320, Co. 419, H.M. 661 and H.M. 647 as standards. The system of replication employed was randomised blocks with four replications and the experiment was repeated for three consecutive seasons. The yield of cane and sugar per acre are furnished in the table below :

Variety	Cane tons per acre				Sugar tons per acre			
	1950–51	1951–52	1952–53	Average	1950–51	1951–52	1952–53	Average
Co. 419 ..	29·72	30·12	27·76	29·20	3·50	3·93	3·74	3·72
I.C. 136 ..	24·23	26·39	35·58	28·73	3·12	3·52	4·89	3·84
H.M. 661 ..	29·22	18·90	27·49	25·20	3·72	2·37	3·69	3·26
I.C. 195 ..	26·24	20·79	27·71	24·91	3·37	2·52	3·46	3·12
H.M. 647 ..	19·85	23·44	24·09	22·46	2·35	2·73	2·76	1·86
I.C. 36 ..	18·25	19·41	27·39	21·68	1·82	1·90	3·26	2·33
I.C. 11 ..	19·97	16·13	26·54	20·88	1·97	1·75	2·76	1·86
I.C. 25 ..	16·52	8·69	24·93	16·71	1·83	0·98	3·42	2·07
I.C. 137 ..	19·54	7·43	15·65	14·21	2·52	0·92	2·68	2·04
H.M. 320 ..	8·92	11·34	10·61	10·29	1·06	1·45	1·46	1·32
Variance ratio (F.)	4·82	4·54	6·37					
F. (5%) ..	2·36	2·34	2·30					
C.D. at 5% ..	9·80	10·82	8·00					

Date of commencement : 8—12—1949 ; 13—12—1950 ; 27—10—1951.
Date of completion : 24—6—1951 ; 15—3—1952 ; 30—3—1953.

* Formerly Irwin Canal Farm, now renamed Visvesvaraya Canal Farm.

The varietal differences in all the three trials were significant at 5 per cent. level of significance but the difference between the varieties Co. 419, I.C. 136, H.M. 661, I.C. 195 and H.M. 647 has not been significant in any trial. Taking the average of all the three trials, it can be seen that I.C. 136, is as good as Co. 419 in point of cane yields and slightly better in respect of C.C.S. Of the other I.C. varieties, only I.C. 195 is comparable with Co. 419.

In a second series of trials at V.C. Farm, two Co. varieties, Co. 417 and Co. 421 and 8 I.C. varieties, I.C. 26, I.C. 29, I.C. 31, I.C. 8, I.C. 201, I.C. 202, I.C. 203 and I.C. 215 were compared with four standard varieties, Co. 419, H.M. 320 and H.M. 661 and H.M. 647. The design employed was randomised blocks with four or five replications and the trial has been repeated over three seasons. Due to lack of adequate planting material, I.C. 201, I.C. 203 were omitted from the first trial. The cane and sugar yields from the three trials are given below :

Cane and sugar per acre in tons

Variety	1947–48		1951–52		1952–53		Average	
	Cane	C.C.S.	Cane	C.C.S.	Cane	C.C.S.	Cane	C.C.S.
Co. 419 ..	42·93	5·36	50·22	6·61	62·15	8·19	51·77	6·72
H.M. 661 ..	46·08	5·97	33·96	4·41	48·15	6·31	42·39	5·56
H.M. 320 ..	33·76	4·34	25·98	3·22	33·75	4·42	31·17	3·99
H.M. 647 ..	53·87	5·97	38·39	4·79	51·65	6·43	47·91	5·73
I.C. 215 ..	55·63	6·85	43·22	5·62	61·00	7·54	53·28	6·67
Co. 417 ..	51·54	6·23	43·42	5·14	59·95	7·74	51·63	6·37
I.C. 203 ..	..	..	36·80	4·48	59·25	7·74	48·03	6·11
I.C. 201 ..	..	..	42·60	5·44	55·15	7·71	48·88	6·58
I.C. 26 ..	40·23	4·75	33·08	3·64	48·25	6·06	40·52	4·82
I.C. 29 ..	27·66	3·13	32·29	3·51	55·54	7·84	38·49	4·84
I.C. 31 ..	31·32	3·57	38·50	4·10	47·24	5·23	39·02	4·30
I.C. 8 ..	38·53	5·05	32·39	3·32	43·70	5·23	38·21	4·53
I.C. 202 ..	27·03	3·23	32·29	3·38	45·20	5·08	34·87	3·90
Co. 421 ..	36·02	3·96	34·40	3·79	42·17	5·19	37·53	4·31
Variance Ratio (F)	2·84		4·08					
F (5%) ..	2·09		1·84					
C.D. @ 5% level ..	13·86		8·83					

Date of commencement : 27–12–1947 ; 22–11–1950 ; 24–10–1951.
Date of completion ; 14–8–1949 ; 29–2–1952 ; 25—1—1953.

The varietal differences as judged by cane yields were highly significant in each case, but the differences between Co. 419, I.C. 201, I.C. 203, I.C. 215 and Co. 417 were not signifi-

cant at 5 per cent. level. Taking the average of all the trials, the average yield of cane and sugar per acre of these 5 varieties are nearly equal.

Similar trials were also carried out at Babbur Farm. The varieties included were I.C. 8, I.C. 11, I.C. 26, I.C. 29, I.C. 39 and 2 Co. varieties, Co. 421 and Co. 423 and 4 standards. The trial was repeated three times, using a randomised block design with four replications, but the results were inconclusive. The fields on this farm contain several alkaline patches and the soil is not quite uniform even within the limited area normally required for a field trial. The result was that the variation in yield between plots of the same variety was wide and the difference between varieties tested did not approach significance. The cane yields obtained are, however, indicated below.

Variety	Yield of cane in tons per acre			
	1948–49	1950–51	1951–52	Average
I.C. 26 ..	14·44	12·17	37·37	21·33
H.M. 661 ..	16·70	16·82	26·05	19·86
I.C. 8 ..	10·95	15·38	31·61	19·31
I.C. 11 ..	13·93	11·08	22·62	19·21
Co. 290 ..	12·16	11·51	31·63	18·43
Co. 419 ..	12·48	13·17	27·42	17·69
Co. 421 ..	14·18	13·04	24·27	17·16
I.C. 39 ..	15·41	13·87	22·77	17·12
H.M. 655 ..	9·51	11·47	30·19	17·56
H.M. 647 ..	10·69	15·00	25·31	17·00
Co. 423 ..	12·81	13·80	23·94	16·85
I.C. 29 ..	11·41	16·51	11·49	13·14

Of these varieties, I.C. 8 and I.C. 26 have been cultivated in bulk on the farm and have given yields comparable to Co. 419 and Co. 290. They produce a good quality of jaggery and ratoon well. The two varieties have been issued to cultivators on a limited scale. The performance of I.C. 26 in the Belur area is quite good and yields up to 40-45 tons per acre have been reported. This variety is likely to get established in that tract.

3. Trials with Recent Batches of Mysore and Coimbatore Varieties

Beginning with the year 1942, the Central Sugarcane Station, Coimbatore, is sending out annually, its best varieties for trial in Mysore. Forty-four such varieties numbered 600 to 644 were received upto the end of 1947. Five of these were found to be promising under Mysore conditions and these along with seven recent Mysore varieties have been compared with four standards at V.C. Farm. The trial has been repeated during three seasons, a randomised block design with four replications being used. The results obtained are tabulated below :

Yield of cane and sugar

Variety	1950–51		1951–52		1952–53		Average	
	Cane	C.C.S.	Cane	C.C.S.	Cane	C.C.S.	Cane	C.C..
Co. 419 ..	18·64	2·51	48·21	6·45	21·07	2·82	29·54	3·93
I.C. 225 ..	18·43	2·42	47·45	6·50	20·45	2·81	28·78	3·91
Co. 636 ..	14·74	1·84	51·23	6·28	18·32	2·39	28·09	3·50
I.C. 223 ..	13·86	1·73	54·92	6·50	16·31	2·17	28·36	3·47
H.M. 647 ..	21·46	2·09	43·86	5·20	17·41	2·16	27·58	3·15
Co. 631 ..	13·33	1·65	48·91	5·82	18·47	2·15	26·90	3·21
Co. 634 ..	21·99	2·49	44·97	5·89	28·69	3·53	31·88	3·93
Co. 623 ..	18·48	1·79	42·43	5·74	14·48	1·78	25·13	3·10
H.M. 661 ..	18·28	2·44	38·00	4·91	20·05	2·54	25·44	3·38
I.C. 224 ..	18·66	1·59	38·76	4·63	15·51	1·77	24·31	2·65
Co. 637 ..	15·22	1·90	44·05	5·19	10·85	1·34	23·88	2·81
I.C. 219 ..	17·24	2·12	44·75	5·13	6·77	0·89	22·92	2·71
I.C. 228 ..	14·25	1·50	35·16	4·66	13·13	1·52	20·85	2·56
I.C. 206 ..	9·63	1·06	46·98	5·83	5·63	0·68	20·75	2·52
H.M. 320 ..	8·80	1·07	38·38	5·21	4·32	0·56	17·16	2·28
I.C. 237 ..	13·29	1·68	21·52	2·86	8·01	1·03	13·20	1·84
Variance (F) ratio ..	4·009		5·26		1·35			
F (5%) level ..	1·93		1·93		1·97			
C.D. ..	5·2		9·03		..			

Date of commencement : 3–12–1949 ; 2–2–1950 ; 8–12–1951.

Date of completion : 31–2–1951 ; 20–3–1952 ; 23–4–1953.

There was great scarcity of irrigation water during 1950-51 and again in 1952-53 and the yields under all the varieties in both the seasons are below normal. But even so, the varietal differences in the first two trials are significant. Taking the average of all the three trials, it is easily seen that both in point of cane and sugar yields the varieties Co. 419, Co. 631, Co. 634, Co. 636, I.C. 223 and I.C. 225 are similar in their performance.

Conclusion

From a consideration of all the trials reported above, it is seen that the performance of the following varieties is nearly equal, both as regards cane yields and C.C.S. per acre.

H.M. 661, Co. 419, I.C. 136, I.C. 195, I.C. 201, I.C. 203, I.C. 215, I.C. 223, I.C. 225, Co. 417, Co. 631, Co. 634 and Co. 636 and H.M. 645 (in Babbur Farm).

Based on the results of periodical analysis they have been grouped into early and midseason varieties as follows :

Early.—I.C. 136, I.C. 201, I.C. 225 and Co. 636 and H.M. 645.

Midseason.—Co. 419, H.M. 661, I.C. 203, I.C. 215, I.C. 195, I.C. 223, Co. 417, Co. 631 and Co. 634.

Of these several varieties, Co. 419 has become well established in the factory zone, and in certain gur areas where *Adsali* planting is in vogue. H.M. 320 continues to be the dominant cane in gur areas and has of late begun to appear in the market as a chewing cane. H.M. 645 is already well established in the *Cheni* areas, H.M. 661 is fast becoming popular. The other varieties have been issued in limited quantities to interested cane-growers, with a view to ascertain their suitability to different localities. I.C. 215 has given high yields in the malnads and there has been a growing demand for the supply of setts. All the varieties listed have been tested for their suitability for gur manufacture and found to be quite satisfactory.

Considered from many points of view the varietal position of sugarcane in Mysore may be considered satisfactory. Co. 419 in the factory zone and H.M. 320, Co. 419, H.M. 661 and H.M. 645 in gur areas are giving satisfactory performance. Pattapatti continues to be the favourite chewing cane, though of late H.M. 320 is also sold for the purpose in the market; but pattapatti is succulent and has a brilliantly coloured rind, striped red and yellow which has a sales appeal of its own. The other varieties listed above, with an yield potential as good as or better than the established types, can easily replace the established varieties, if for any reason such a necessity arises.

Summary

(1) The work on varietal improvement of sugarcane in Mysore in recent years is briefly reviewed and the results of several varietal trials are reported.

(2) H.M. 320 in gur areas and Co. 419 in the factory zone are the dominant varieties. H.M. 661 and H.M. 645 are getting established in particular localities. I.C. 215 is becoming popular in the malnads.

(3) From a consideration of the results, the following varieties are found to be suitable for cultivation.

(*a*) *Early Varieties.*—H.M. 645, Co. 636, I.C. 136, I.C. 201 and I.C. 225.

(*b*) *Midseason Varieties.*—Co. 631, Co. 634, Co. 417, I.C. 195, I.C. 203, I.C. 215 and I.C. 223.

(4) The varietal position in Mysore in respect of sugarcane is quite satisfactory.

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THE INFLUENCE OF SOIL BASES ON THE POTASSIUM UPTAKE BY PADDY PLANTS

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The presence of abnormal amounts of certain of the mineral elements in soils are known to cause infertility in soils or else to reduce the fertility of the soils otherwise well supplied with the usual nutrients. One of the causes of this type of infertility is the presence of abnormal amounts some of the exchangeable bases resulting in an unbalance in the proportion of the different bases. Thus the presence of magnesium or sodium in excessive amounts as to disturb the normal distribution of calcium, magnesium, potassium and sodium, is known to reduce the fertility of soils.[1-4]

Aiyer[5] working with certain soils from Mandalay recognised the existence of abnormal amounts of magnesium in the soil exchange complex which caused infertility of the soil and which could be overcome by application of heavy doses of potassic fertilizers. A study was made of the influence of varying proportions of calcium and magnesium on plant growth and the extent to which potassium manuring could relieve the distress caused by this type of unbalance. This paper sets out the information obtained with nutrient culture experiments in which the toxic symptoms due to excessive quantities of magnesium were found to be relieved by application of potash salts as also by application of calcium salts.

Experimental

Paddy seedlings (selection of G.E.B. 24 variety) were grown in washed sand and when 3 weeks old were transferred to the culture solutions contained in 1 litre glass bottles suitably darkened to protect them from the action of light. These solutions were five in number and had the compositions set out in Table I.

The experiments were conducted in quadruplicate and the solutions were changed every 10 days. The composition of each of the solutions were so adjusted as to supply all the major and minor element nutrients in constant proportion, excepting those of calcium, magnesium and potassium which were supplied in the varying proportions indicated here. The record of the growth

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Table I

Composition of the nutrient solutions used

Salts used	Concentration of salts in mg. per litre					
	Full K	1/10 K	1/100 K	Minus K	1/100 K with Ca/Mg altered	Element supplied
NH_4NO_3 ..	340	340	340	340	340	N
KNO_3 ..	170	17	1·7	..	1·7	N, K
KCl ..	300	30	3·0	..	3·0	K
$CaCl_2$ ..	25	25	25	25	25	Ca
$Ca(H_2PO_4)_2 \cdot H_2O$ ..	50	50	50	50	50	Ca, P
$MgSO_4 \cdot 7H_2O$ ..	250	250	250	250	50	Mg, S
$CaSO_4 2 \cdot H_2O$ ..	..	..	..	..	125	Ca, S
$NaNO_3$ ..	..	140	140	140	140	N, Na
NaCl ..	..	240	240	240	240	Na
Ferric Citrate scales ..	54	54	54	54	54	Fe
$MnCl_2 \cdot 4H_2O$.	36	36	36	36	36	Mn
H_3BO_3 ..	1·1	1·1	1·1	1·1	1·1	B
$ZnSO_4 \cdot 7H_2O$ ..	0·9	0·9	0·9	0·9	0·9	Zn
$CuSO_4 \cdot 5H_2O$ ..	0·2	0·2	0·2	0·2	0·2	Cu
K milliequivalents per litre ..	5·76	0·58	0·06	..	0·06	..
Ca+Mg milliequivalents/litre ..	2·94	2·94	2·94	2·94	2·94	..
Na ..	..	5·2	5·7	5·8	5·7	..
K : Ca+Mg ..	2 : 1	0·2 : 1	0·02 : 1	..	0·02 : 1	..
Ca : Mg ..	1 : 2	1 : 2	1 : 2	1:2	6 : 1	..

of the plants were made periodically by measurement of the length of the plants, counting of leaf-blades, etc., and were also photographed when 8 and 10 weeks old. The plants were finally removed when 12 weeks old and data relating to the growth of the plants, and their respective weights were recorded and the same is given below :

Table II

Measurement of shoot, root and blades of plants—average of four plants

Treatment	Length of Shoots in mm.	Length of Roots in mm.	No. of blades
1 Full K ..	250	50	12
2 1/10th K ..	243	42	7
3 1/100th K ..	130	38	4
4 No K ..	179	44	6
5 1/100th K with Ca/Mg altered	197	35	6

TABLE III

Dry weight of plant parts—average of four plants

Treatment	Shoot in mg.	Root in mg.
1 Full K ..	43·9	9·4
2 1/10th K ..	36·8	7·4
3 1/100th K ..	18·5	5·7
4 No K ..	29·9	6·3
5 1/100th K with Ca/Mg ratio altered	30·2	5·1

DISCUSSIONS

It was observed in the case of treatments 2, 3 and 4 that the plants exhibited symptoms of potassium starvation as noticed by a rolling of the leaves, curling and drying at the tips. The nodes of the plants in these treatments when examined showed an accumulation of iron, in abnormal amounts which is recognised to result from potash starvation. In the case of the plants in the treatment given heavy dose of potash, the plant growth was observed to be normal and accumulation of iron at the nodes was not noticed. The alteration of the Ca : Mg ratio by having Ca in excess of Mg while keeping K at the minimum, namely, 1/100th K, showed that K deficiency symptoms were not noticeable and no iron accumulation could be detected though the general growth of the plant was not optimum nor as satisfactory as in the case of Treatment 1. The above observation lead us to infer that the presence of high amounts of Mg obviously inhibit the absorption and utilisation of K by the plants possiblly due to unbalance in concentration of the different alkali ions and the ionic antagonism known to exist between Mg and K. It appears that these harmful effects can be overcome by application of : (1) heavy doses of K, or (2) by applying large doses of calcium so as to bring about a favourable Ca : Mg ratio. The latter of the above two treatments is a cheaper practice and more economical for treating soils affected by presence of excessive amounts of soluble magnesium salts.

SUMMARY

An experiment was conducted in culture solutions to see if the harmful effects of high Mg concentrations on the K absorption by paddy plant could be mitigated by supplying soluble

calcium and altering the ratio of potassium to the divalent ions instead of resorting to applications of heavy doses of K salts. The ratio of Ca : Mg was altered so that there was more calcium compared to Mg in the culture solution supplying the minimal dose of K. It was observed that the symptoms of K deficiency exhibited by the plant in the presence of high Mg concentration was not noticeable and the plants showed healthy appearance and growth, when this ratio was favourably altered.

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ROLE OF POTASSIUM IN PLANT NUTRITION

Without sufficient available potassium in the soil, crop plants suffer in reduced vigour, greater susceptibility to disease, impairment of growth processes—including assimilation of carbon dioxide—failure to develop normally and translocate starch within the plant, and in other ways equally adverse. On the other hand, the presence of an adequate supply of available potassium in the soil promotes the health and improves the quality of the plant, insures greater efficiency in photosynthesis, increases resistance to certain diseases, offsets the effect of an oversupply of nitrogen and helps the plant to utilise soil moisture more advantageously, particularly during droughty spells. A plentiful supply of potassium, moreover, insures the development of well-filled kernels in cereal grains and gives stiffness to the straw, encourages the growth of different leguminous crops, assists in the production of starch- or sugar-forming crops.—*U.S.D.A. Year Book,* 1938, pp. 401-02.

Selected Article

THE JAPANESE METHOD OF RICE CULTIVATION IN INDIA

By K. Ramiah*

Main Features of the Japanese Method

The main principles of rice cultivation as followed in Japan which produces the highest acre yields in Asia are well known to the technical officers of the Departments of Agriculture in India, but no active steps had until recently been taken to highlight them among rice-growers as a special campaign beyond what was being done in regular extension work. What actually is the Japanese method of rice cultivation ? The most important features associated with it are : (*i*) selection of good and heavy seed for sowing in the seedbed, (*ii*) sowing the nursery thinly, (*iii*) having seedbeds raised a few inches above the level of the field, (*iv*) manuring the seedbed adequately with both organics and inorganics, (*v*) removing the seedlings when ready with the least amount of damage to the roots and transplanting them in lines with adequate spacing, (*vi*) heavily manuring the fields with organics and inorganics, and (*vii*) frequent inter-culturing or stirring up of the soil in between the rows, 4 to 5 times when the crop is growing. The State Governments have been consulted and thousands of charts and leaflets, suitably illustrated, have been prepared for distribution to rice farmers throughout the country. These leaflets written in all local languages describe the methods suitably modified according to the conditions obtaining in the different States. Arrangements have also been made to train workers, officials and non-officials, who will be in charge of the extension work connected with this campaign.

Relative Importance of the Several Features

Although all the points (*i*) to (*vii*) mentioned earlier together constitute the Japanese method there is no experimental

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data to determine the relative importance of the different factors contributing to increased yields. The Indian Council of Agricultural Research has suggested to all the State Departments that they should carry out a suitable experiment in their research stations to obtain reliable information on the above point. But the figures of a simple experiment already carried out in Bombay State dealing only with some of the factors show clearly that the factor having the largest effect on yield was the fertilising of the field. The contribution due to the manuring of the seedbed was very much less, hardly one-third of the contribution by field manuring. The contribution due to inter-culturing was still less, about a third of the increase due to seedbed manuring. Even the small benefit accruing from the manuring of the seedbed may be limited to Bombay and not applicable to conditions in other States. This is from a rough preliminary experiment and more reliable information is bound to come from the better planned experiments that are being undertaken now in all States. There is, however, no doubt that fertilizing of the field is bound to be the most important contributing factor, and in advocating the Japanese method the greatest emphasis has to be placed on this. There is sufficient experimental data available already in different States with regard to the optimum quantities of manures or fertilizers to be used for rice grown in them. So long as the dose recommended is kept within the maximum dose determined by experiments, it should be safe.

Seedbed

It has been mentioned already that the several features advocated with the Japanese method of rice cultivation are not all new. For example, sowing the seedbed thinly to get strong and sturdy seedlings for transplanting is a recognised improvement and has been advocated as an item of propaganda in Madras State for over 30 years. In important rice areas of that State this improved practice is already being followed. It is easy to adopt raised seedbeds when a dry nursery is raised. With regard to the wet nursery, the emphasis should be on long and narrow beds so that levelling can be made perfect resulting in satisfactory germination. With long and narrow beds with channels separating them, one cannot but have a slightly raised seedbed.

Selection of heavy seed for sowing by soaking the seed in salt-water has been experimented with in different States. In

genetically pure varieties developed from a pure line such selection is of value only in the case of early-maturing rices, say, 110 days and less, and not in varieties which take 160 days and more to mature. In the latter case it should be quite enough to eliminate light and half-filled grains which float when the seed is soaked even in ordinary water. There may be no necessity of using salt water in this case. The main advantage in selecting heavier seed is that such heavy seed germinates quicker and the seedlings are uniform in size at the time of planting. Manuring of the seedbed is, however, important and emphasis should be more on the organics rather than the inorganics, so that with a thick layer of organic manure on the top, the pulling of seedlings will be easy and with little damage to the roots. Under Indian conditions, too heavy manuring of the seedbed may be even harmful, particularly when transplanting cannot be done at the stipulated time due to inefficient water control.

Spacing of Plants

In Japan the spacing to be adopted between lines and the number of seedlings to be planted per hole has been determined by regular experiments. The research results help them to determine the total number of plants to be planted per unit area, the number of plants to be planted per hole being adjusted to the minimum spacing to be allowed between lines to facilitate inter-culturing. Population density per unit area is an important factor determining yield in cereals. In India also we have data to determine the spacing to be adopted in the fields but this varies according to the varieties grown. While most Japanese varieties of rice take 135-50 days to reach maturity, we have in India much earlier and very much later varieties to grow. For any inter-culturing to be done without damage to the plants, 9″ between lines will be the minimum distance. Adopting this spacing for both early and late varieties should mean a larger number of seedlings per hole for early-maturing varieties and fewer plants per hole for late-maturing varieties. Of the two factors involved, namely, spacing between lines and number of plants per hole, the former is more important and necessary adjustments will have to be made according to the maturity period of the variety. With 10″ spacing between lines 3 to 5 seedlings per hole for the varieties maturing in 120 days or less, and 1-3 seedlings per hole for late-maturing varieties may be the optimum numbers.

Inter-Culturing

Planting in lines and frequent inter-culturing are very special features of the Japanese method. Here emphasis has to be on inter-culturing and planting in lines facilitates the operation. Inter-cultivation as practised in Japan does not consist merely in removal of weeds but in stirring the soil between the plants to a few inches depth. In well-prepared wet rice, weeding is not a problem and a certain amount of weeding is usually done in India. Moreover, this stirring of the soil adopted in Japan goes with intensive manuring, and perhaps such stirring helps the plant to assimilate better the added nutrients. Stirring of the soil without adequate manuring may not do much good, and in fact, the results of the preliminary experiment conducted in Bombay confirm this view. The number of inter-culturings will depend upon the variety grown. It may not be possible or necessary to have more than two for an early variety while up to five may be desirable for a late variety. The last inter-culturing should be before the primordia are formed, *i.e.*, about two weeks before the short blade stage.

Manuring of the Field

Questions arise as to the quantity of the manure to be applied and the form in which it is to be applied. In Japan the very large quantities of manures applied to rice are partly in the organic and partly in the inorganic form, the latter containing the nutrients, N, P and K. Because of the varying soil and climatic conditions obtaining in different parts of India, it is not advisable to follow a standardised schedule. Moreover information is available, though on a limited scale, mainly from experimental stations (Bihar State is an exceptoin), on the optimum and maximum doses of fertilizers to be used. In Japan all organic wastes are scrupulously collected and made into compost and this forms the main source of organic manure. In India, the only organic manure available is cattle manure, but the quantity is limited. Fortunately, growing a green manure crop and turning it in is a practice that is slowly but surely extending and all available information points out that this is the best and the cheapest form of fertilizing rice fields. Available information points out that where 3-4 tons of green matter can be turned in, there is no necessity to supplement it with inorganics. There are, however, facilities needed to make the practice of green manuring a more general one, and in any

case it cannot be practised universally. The only means of fertilizing rice fields is to apply the available small quantities of organics in the way of cattle dung, compost and green manure and supplement them with chemical fertilizers. Each State has drawn up its schedule for fertilizing rice fields which contain both organics and inorganics. The inorganic source for nitrogen is universally ammonium sulphate and superphosphate supplies phosphorus. Some States like Bombay and West Bengal are recommending special mixtures where oilcakes and bonemeal are added to the inorganics to replace part of the nitrogen and phosphorus requirements.

Nitrogen—the Chief Requirement

Nitrogen is the most important requirement of Indian soils and it has been found that 20 lb. of N per acre is the minimum that can give a satisfactory response in most places. The optimum dose, however, varies from 20-60 lb. and it is even beyond 60 lb. in a few areas like parts of Bombay. So long as the total nitrogen requirement cannot be met by green manure, the use of ammonium sulphate for rice has to become an established practice. It is not necessary at this stage to go into the question of the possible bad effects on the soil of a continuous application of ammonium sulphate. Acid soils where its application is likely to be harmful, are limited in extent. On most rice soils in India, with the limited quantities recommended supplemented by organics and phosphorus there is no necessity to be unduly apprehensive of such a bad effect. Research is going on and more fertilizer experiments under cultivators' conditions are being undertaken, and where a harmful effect is likely to result from the use of ammonium sulphate other forms of introgenous fertilizers can be considered. The use of more manure and commercial fertilizer is the most important factor connected with the Japanese method, and in India it should mean a greater use of ammonium sulphate for the present, and possibly a change over to other forms of nitrogenous fertilizers in the future where such a change is found necessary.

Method of Applying Fertilizer

The Japanese method of applying the fertilizers consists in applying all the phosphorus and potash and a portion of the nitrogen just before planting and the balance of nitrogen either in a single dose soon after planting or in split doses, one after planting and another much later, a few weeks before heading. Where the land is ploughed dry and then puddled and levelled, which

is the practice in Japan, the initial application of the fertilizer is done when the soil is dry. The interval of time between this application and puddling for transplanting is never more than a few days, not more than a week. This might be followed in India too where dry ploughing of the soil is practised. In areas where preparation of the land begins after letting in water the initial application of the fertilizer has to be at the time of planting, with a minimum amount of water in the field. With regard to single or split doses it may be useful to follow the information available from experiments. In the case of an early-maturing variety it may be safer to apply it in one dose soon after transplanting. Split doses may be considered only in the case of late-maturing varieties, and even here according to existing information it has not been found useful to postpone the last application six weeks beyond transplanting. Moreover, split doses may not be feasible where efficient water control does not exist.

Direct Sowing

The popularization of the so-called Japanese method should result in greater use of fertilizers in the country, and this happens to be the easiest way of stepping up acre yields. It has to be understood that the Japanese method can be introduced only in areas where raising of seedbed and transplanting the crop is regularly practised, and where reasonable water facilities exist. Rice is also grown as a pure rainfed upland crop in Japan. Here the crop is sown in lines, nearly a foot apart, and the space between is frequently inter-cultured and the soil earthed up on either side. Manures and fertilizers are applied at the base of the plant before earthing up. This practice is capable of being followed in parts of India where rice is generally broadcast just before the break of the south-west monsoon. Recently even for transplanted rice, Japan has been experimenting with sowing the seed drectly in lines and the results are said to be extremely satisfactory. The yields have been found to be as good as and even better than from a transplanted crop, and the additional advantages are the saving in labour and water use. There is no doubt there is scope for undertaking such experiments in parts of India.

Improved Varieties and the Japanese Method

In the Japanese method, fertilizing the field and growing an improved variety of rice are inter-dependent. According to the Japanese, improved varieties do well only when intensively

fertilized, and the best returns are obtainable from the use of fertilizers only when improved varieties are grown. Suitable improved varieties are available to meet the requirements of different rice areas of Japan and the determination of varietal response to fertilizers is an integral part of breeding research. This question has perhaps not received much attention in India. The maximum yield of grain under ordinary methods of rice cultivation as generally followed has been the main objective in breeding. It has been found, however, in most places that the improved varieties have done very well with intensive manuring. In Japan there is a good organization to multiply and spread improved varieties, and in fact, Japan is the only country in Asia which has the larger part of the rice area, about 70 per cent., covered by improved varieties. In India the intensity of breeding and evolution of suitable varieties for different areas varies among different States, and it may be said that States like Madras, Bombay and Madhya Pradesh do have a range of varieties to suit most of the requirements. The total area under improved varieties is not, however, impressive although according to information available with technical officers, the area as given in official statistics is a gross underestimate. The area given in statistics has been calculated mainly on the basis of the quantity of seed handled and distributed by the department whereas there is an appreciable amount of spread taking place among cultivators themselves. Moreover, there has been no satisfactory attempt made to determine the area under improved varieties which under conditions obtaining in India, a rice-deficit country, is beset with special difficulties. Perhaps collecting information on varieties along with random sampling for estimating yield could give a more reliable picture about the spread of improved varieties.

There should not be any difficulty in following the Japanese method in States which have already a range of improved varieties suited to different needs but in others where either suitable varieties for different areas are not available or the suitability of the existing varieties to such areas has not been determined the matter needs immediate attention. There is no doubt that the successful spread of the Japanese method should stimulate more intensive work in breeding to obtain varieties that will stand up to intensive manuring.

Implements Connected with the Japanese Method

Fortunately the taking up of the Japanese method does not involve any outlay on special implements. Planting the seedlings

in lines can be done by stretching a marked string across the field from bund to bund and shifting it after planting each line. This should be an easy operation where fields are small, about ½ acre or less. It may be a problem in areas where the fields are large as in the flat river deltas. In Japan and Formosa where rice is always planted in lines, there is a special improvised implement, a revolving drum made of cheap and light wood or even split bamboo which can be dragged along the field after it is properly levelled and where water has been drained off, and it leaves marks in the soft mud in a chessboard fashion. Seedlings are planted where two lines intersect. Attempts are being made to design such an implement also in India. With regard to inter-culturing or stirring of the soil in Japan, there are special rotary weeders in use. Often a few of these of different sizes form essential equipment for every rice farmer. The rotary weeders have been imported and tested in India, and they appear to be satisfactory. They are, however, somewhat expensive. One of the agricultural machinery manufacturing firms in Calcutta has turned out a weeder which is quite as efficient as the Japanese one. It costs Rs. 20 each, and already a small demand has developed. In Bombay and Madras the departments have designed a special hand hoe with curved teeth which somewhat answers the purpose, although they cannot be as efficient as the Japanese weeder. However, they cost only a rupee or less each.

Economics of the Japanese Method

The Japanese method of rice cultivation does involve an appreciable amount of hard labour and attention to details, much more than the general Indian rice farmer is accustomed to. A question is often asked whether the Japanese method of rice cultivation is economical and whether the economics of the method have been determined for Indian conditions. In Japan, as in parts of India, the size of the holding is extremely small and the rice farmer has to put in unremitting and incessant labour to get the maximum possible out of the land so that he can make a decent living out of it. All members of the family including children work in the field and the question of economics, *i.e.*, calculating in money value every bit of work which the farmer or members of the family put into the field, does not arise. In fact, in Japan there is very little outside labour actually hired for the field work. Where necessary the farmers help each other in operations like transplanting or

harvesting. In India also the taking up of the Japanese method must involve more work on the part of the rice farmer. It will not, however, be justifiabe to calculate the money value of every bit of field work as if he engaged labour for every field operation and paid for it. If this is done, it may perhaps not prove highly economical. In Bombay the special leaflet does show the economics of the Japanese method and it appears to be highly profitable. There will, of course, be more labour involved in the preparation of seedbeds, weeding of the seedbeds, transplanting seedlings in lines, and frequent inter-cultivation later. How far the farmer himself can contribute to this additional work or will be obliged to hire labour will depend upon circumstances of the individual, but in any case, it has to be understood that the Japanese method is essentially a method suitable for small holdings and where the farmer himself is expected to contribute most of the labour involved. It follows also that there must exist sufficient facilities or incentives to encourage the farmer to put in more work in the field.

Facilities and Incentives

While so far the technical aspects of the Japanese method have been discussed, there are certain facilities which the rice farmer in Japan has and which the Indian rice farmer has to be given to make the campaign an unqualified success. Principally these facilities are (1) making the fertilizers available to him as near to his door as possible, and (2) providing credit facilities for him to purchase his fertilizer requirements. The former is perhaps not receiving as much attention as it should. The main requirement is the opening of a large number of depots in the interior of the country so that at no place the farmer has to travel more than 5 miles to get his requirements. Taking Madras State, the largest user of fertilizer in India, in two districts, East and West Godavari, where people have been using fertilizers, there is only one depot available at each taluq headquarters, about 13 in all for the two districts. While farmers accustomed to use fertilizer continue to do it, the practice has not spread to neighbouring areas where practically identical conditions exist. The opening of more depots and arranging for demonstrations in new areas could easily double the consumption of the fertilizers. Expenditure on these items should be only a fraction of the cost involved in the whole campaign, and it should be quite worth undertaking. While it may not be possible to develop an extension service in India

on the scale available in Japan, at least a small strengthening of the service is necessary if the campaign is to prove an unqualified success. How soon the working of the community projects and training non-official personnel will effectively help extension work remains to be seen.

The Departments of Agriculture are fully alive to the problem of increasing the number of depots where seed and fertilizers can be made available to rice farmers but the main difficulty appears to be finance. Any extension of the existing facilities could have the maximum effect in Madras State where the farmers are already fertilizer-minded, much more than in other States. With regard to credit facilities, all State Govenments have arranged to grant loans of fertilizers to rice farmers.

For the present, the supply of fertilizer at reasonable cost and making it easily available on credit would be sufficient incentives. There is, of course, the price of the produce which is, however, controlled, though there may be variations in this from State to State. With an average price of Rs. 10 per md. (82 lb.) of paddy and Rs. 400 for a ton of ammonium sulphate, the application of 100 lb. of ammonium sulphate costing Rs. 17 can be expected to bring an additional yield of 3-3½ md. of paddy which means a profit of Rs. 13-18 per acre. With a lower price for paddy or a higher price for the fertilizer the profit will of course be less. Until recently, ammonium sulphate was being sold at Rs. 350 a ton, and including transport and incidental charges was costing actually about Rs. 400 to the cultivators in most places. In Madras the fertilizer was actually costing the farmers more than Rs. 450. To encourage the use of the fertilizer and to give an incentive to the Japanese method, the Central Government which controls the production, import and distribution of the fertilizers has now reduced the price to Rs. 290 a ton which is a great incentive. This means that the farmer will not have to pay more than about Rs. 350 per ton at his door. Whether further incentives will be required can perhaps be decided as the programme progresses.

—*Courtesy*: *Allahabad Farmer*, 27 (6): 214-20, November 1953.

Extracts and Selections

KRILIUM AND OTHER SOIL CONDITIONERS

[Krilium and in the wake of it other soil conditioners have aroused worldwide interest. From ancient times the principal soil conditioners and improvers were farmyard manure, green manure and many types of organic matter. In temperate regions organic matter plays a very important role in improving the tilth and influencing the soil structure. But in tropical countries like ours the effects of organic matter are very transitory, lasting for hardly a season. Synthetic soil conditioners like krilium may prove of great benefit in building up the soil structure of tropical soils. Experiments with krilium and similar soil conditioners are still in the early stages but thé following article by Charles R. Koch in *Farm Quarterly* describes how these synthetic poly-electrolytes work to stabilise soil structure.—*Ed.*]

Charles Allen Thomas seems destined to go down in history as the man who gave the world a new word—krilium—and a new way to make good soil from bad. Thomas is President of the American Monsanto Chemical Company, which developed a substance able to turn cemented or compacted soil which a plough could not break up into a beautiful, easily crumbled, loamy soil overnight.

One day when Thomas was observing the progress of his crops on a well-fertilized piece of land, like any farmer, he was puzzled by the striking contrast between the neighbouring rows. Since fertility definitely was not the cause of the phenomena—the rows were within a few feet of each other—what was ?

His instinctive reaction as a research chemist was to probe this question, to find out what was causing the difference. The answer proved to be a difference in soil structure between the rows, and the solution which the Monsanto Company has developed to improve the poor soil structure was krilium.

Actually, modern scientific developments are somewhat slower and less colourful than this. Krilium and its kindred conditioners are an excellent example of the painstaking effort and the teamwork which go into scientific research.

Long before the beginning of World War II, soil scientists had been impressed with the apparent relationship between soil structure and productivity. Dr. J. H. Quastel, Professor of Bio-

chemistry at McGill University in Montreal, Canada, had worked along these lines. He was convinced that the application of the right sort of chemical to a poor soil would improve its structure and productivity. While working for the Agricultural Research Council in England during World War II he had proven that such was the case. The problem was to find an inexpensive chemical which would not poison the soil or the plant.

The Ohio Experiment Station long had been familiar with the problem of the old lake bed soils in the American Midwest which were once the most productive in the corn belt but which under continual cultivation were becoming steadily heavier and declining in tilth and nitrogen content. Experiments with these soils showed a definite relationship between structure and productivity and pointed up the importance of the proper cropping system in controlling the type and stability of the soil structure.

Becoming seriously interested in the problem, Monsanto Chemical Company invited Dr. Quastel to become adviser to an ambitious agricultural project and set its research men to work using the data already at hand. The compounds produced experimentally were sent to various experiment stations and individual co-operators who tested them under both laboratory and field conditions. Finally, after several years of intensive effort, in December 1951, news of the development of the artificial soil conditioner was released.

For the information of those who want to go into the technical side of this material, here is some chemical background. Monsanto uses as the base of its product a compound known as CRD-186. This, they say, is a modified vinyl acetate maleic acid compound. Other processors are using a hydrolyzed polyacrylonitrile. Acrylonitrile is a polymer which has been produced for a number of years by the American Cyanamid Company. It is used in the processing of such synthetic fibres as Dynel and Orlon, fibres that find their way into bathing suits, dresses, shirts and all sorts of dry goods, and it is also the base of a material known by the trade name of Aeropan which is used as a mud-conditioning compound in oil well drilling. American Cyanamid Company's soil conditioner, Aerotil, is made from acrylonitrile as are also a number of others now on the market.

What the conditioners do and how they work is more important to the farmer, however, than their chemical formulæ.

Possibly the first thing that must be made clear is that the polymers are not fertilizers. They add nothing whatsoever to the soil in the way of plant nutrients. Their one function is to improve soil structure ; or more correctly, they stabilize soil structure after it has been improved by tillage methods of physically creating structure. They are powerless in themselves to create structure. Furthermore, they are of value mainly on silty or clayey soils. In sandy soils, or soils with a great deal of newly incorporated organic matter they are of little use.

To understand how conditioners work requires a little knowledge about soils. First, soils have a certain texture, that is, the mineral particles in the soil can be classified according to their size as sand, silt or clay. Sand is coarse ; silt particles are considerably smaller than grains of sand ; and clay particles are of microscopic size. Besides texture, most soils have what is referred to as structure, which pertains to the manner in which the individual grains of soil material are arranged within the soil mass. Most commonly, they are grouped into aggregates of different sizes and shapes, and in soils of good tilth the aggregates usually vary from pinhead to pea-size. Texture and fertility, of course, are of prime importance in their influence on productivity, but the productivity of even a very fertile soil will be decidedly limited unless its aggregates are of the proper size and of stable character.

Soils with a granular or crumb structure are most favourable to the growth of plants. In nature this structure is brought about by the action of soil bacteria which work in and upon organic matter in the soil, producing a gum referred to as a polyuronide which serves to bind the soil particles into aggregates. These polyuronides, however, are themselves subject to bacterial deterioration causing the aggregates to be of unstable character. Moreover, there is something of a vicious circle here in that bacteria cannot function well in a soil of poor, tight structure due to a lack of aeration, so that a soil in most need of this treatment is least likely to receive it.

Krilium and the other soil conditioners function as artificial polyuronides to improve the structure of heavy clay soils—soils that are sticky and unmanageable when wet and which dry out into hard unworkable clods.

The tightness and clods of clay soils are caused by a property known as plasticity which makes it possible to mold wet soil in various forms. It is a property peculiar only to clay soils. The water breaks down the aggregates leaving the soil with a single grain structure which is almost impervious to tillage. The problem with this type of soil always has been to break up this single grain structure and to increase the aggregates. In so doing plasticity is not only reduced but drainage is promoted and tilth improved.

Another important condition brought about by the proper management of clay soils is the improvement of water-air relationships—that is an increase in porosity. Porosity is a term used by soil scientists to describe the percentage of the total volume of the soil mass occupied by the pores of the soil. The ability of the soil to hold water as well as the volume of its air-space depends upon the shape and size of the pores together with the total surface area of the soil grains.

Three forces cause the movement of water through the soil—gravity, heat and capillary tension. Heat vaporizes the water and allows it to move through the air in the soil ; gravity pulls it downward, and capillary tension draws it upward or across just as a lamp wick takes up oil or a blotter takes ink. If the pore cavities are large, capillary tension will be reduced or entirely inactive and gravity quickly will draw the water to lower levels ; if they are small, the capillary action will be the dominant one in the soil.

Usually, sandy soils have much larger air volumes than the heavier-textured soils because they have larger pores from which gravity removes the water. Clays and clay loams have very fine pores which maintain maximum capillary tension and thus water volume is high and air supply low ; so low, in fact, that the supply of oxygen is insufficient for the needs of plant roots and for the action of aerobic bacteria. The development of granular structure greatly increases the air volume in these soils. That is where conditioners are helpful.

Ordinarily, granulation is a condition achieved only by a long and difficult process. Until now it has been induced by the introduction of organic matter into the soil, by ploughing down manure, cover crops, peat moss or compost. Nature accomplishes the task with the polyuronides produced by the bacteria.

The new synthetic soil conditioners—called polyelectrolytes—work on a principle of magnetic attraction. When they are dissolved in water their ions develop charges which are attracted by the clay particles to form the desired aggregates. Stabilization of the aggregates is accomplished almost immediately. So far as is now known the aggregates have a relatively permanent stability, if undisturbed, but are broken down slowly by ploughing and cultivating. They are not readily subject to bacterial deterioration. Test plots at Ohio State University in Columbus, now in their third year, still show good aggregation. As a matter of fact, the freezing and thawing of winter seems to aid the work of the conditioner.

Because of their newness and, up to now, their prohibitive cost, farmers have had little opportunity to try the conditioners on their fields. But results coming out of the experiment stations are extremely heartening—with one qualification. Dr. W. P. Martin, Professor of Soil Science in Agronomy at Ohio State University, who has been active in this project almost from its inception, speaking for his colleagues, Drs. Volk and Taylor, says that "We have reached the point where a period of disillusionment will set in. The public has been told of the wonders of these conditioners. The material is being placed in their hands. But it must be used very carefully and with strict attention to instructions. If not, the results will be disappointing.

"A conditioner does not create miracles. The gardener or farmer may not note any ease of tillage right away. The conditioner must be worked into the soil. These conditioners do not create soil structure. They simply stabilize or preserve a good structure once it has been established."

There are now about 36 soil conditioners of the polyelectrolyte type on the market. Some are powders, some are in flake form, and some are liquid. Krilium, the subject of the original announcement, is a powder. To apply it, the ground should first be ploughed and worked with a disc or rototiller ; then the powder is spread over the ground and worked in with another discing or rototilling.

Another important point in application is that the powder must be absolutely dry. If it becomes wet during the process it forms a gelatinous mass with which it is impossible to achieve

good incorporation. Once it is worked in, the powder is dissolved by the moisture in the soil and the improvement in aggregation and structure is immediate. Krilium apparently can be applied as successfully at one season as another.

Comparing the relative merits of the powder with the liquid form, Dr. Firman E. Bear, Chairman of the Soils Department, Rutgers University, New Brunswick, New Jersey, and one of the top agronomists of the United States, says :

> "It is our opinion from studying these materials that the liquid forms cannot be expected to be very effective as soil conditioning agents. The best results are obtained from the use of dry powders, thoroughly mixed with a relatively dry soil."

At this point the all-important question is how much conditioner is needed. To do the best job of structure building, krilium should be worked into the top 3-6" of soil. Five lb. of the material will treat 40-80 square feet within that depth range. In fieldwork probably, it is not necessary to treat the entire area. Experiments are now going forward testing the practicality of applying the conditioner in the seed band so that only the soil in the immediate vicinity of the plants to be benefited is treated. For the prevention of crusting to improve germination or for erosion control it has been found that as little as one-half pound per 100 square feet (200 lb. per acre) has been effective.

This type of application, incidentally, seems to be the spot where the use of liquid or soluble conditioners might be of greatest value. Such material can be sprayed on in a precise narrow band affording maximum application efficiency.

A great deal already has been said about the manner in which krilium and its associates increase and stabilize the soil aggregates. For example, silt loam in the American South usually has 20-30 per cent. water-stable aggregates larger than 0·25 millimeter. Treatment with 0·1 per cent. krilium under laboratory conditions immediately increases this to as much as 90-95 per cent.

Tests at experiment stations show that this improvement in aggregation produces a friable, easily worked soil, neither as sticky when wet, nor as hard when dry as untreated soil, and by increasing porosity it brings about better drainage and in-

creased aeration. This is of tremendous benefit since many soils are limited in their productivity because they suffer from lack of oxygen. If the pores are opened so that the gravitational water can find its way to lower levels, both the plant roots and the bacteria which need air will be able to function in conditions to their liking.

This ability to make soil receive water faster and in more abundance also reduces run-off during and immediately after a rainfall and is a factor in controlling loss of top soil from erosion.

It has been found that evaporation from the surface of a treated soil is much slower, possibly as much as 40 per cent. slower, than from the surface of a similar untreated soil. What happens is that the loose, friable surface layer of treated soil is so open that capillary action is stopped. This loose layer acts like a mulch ; the surface appears much dryer than would ordinarily be the case and the ground can be satisfactorily tilled when it contains a fairly high percentage of moisture.

One of the greatest advantages offered by the conditioners would seem to be their ability to aid the rapid and effortless emergence of frail young seedlings by preventing the slaking and crusting of the surface soil. This characteristic provides one of the most spectacular of the laboratory demonstrations. The emergence of kidney beans, for instance, from soil which has been treated and watered is practically 100 per cent., whereas in untreated soil the emergence usually will run about one in five. In the treated soil the seedlings come up through the loose ground with little effort, while in the untreated soil they are stopped when they reach the hard, crusted surface. Carried over to field conditions this ability to give seedlings a helping hand should be a boon to the farmer.

Erosion control is a problem which has received very special attention from the Monsanto people, and their progress has definitely passed the experimental stage. In treating road banks and slopes a mixture of krilium, seed and fertilizer is sprayed directly on to the soil. The conditioner forms a film which lets water pass through into the soil and permits the seedlings to sprout without difficulty while holding the soil firmly. A pound of krilium per 100 square feet (about 400 lb. per acre) will do the job of a straw mulch applied at the rate of 2-4 tons per acre. But experience is showing in some cases that on spring seedlings the best results are still obtained if a

straw mulch is used with the krilium. The straw provides the necessary shade.

The final test of soil conditioners, as of any device introduced into farming, is in crop yields. Experiment stations have had some interesting results. For instance, the Ohio Experiment Station got an increase of 40 per cent. on oats planted as a nurse crop for alfalfa. Field corn yields were increased by 15 bushels per acre, while carrots responded with a 21 per cent. increase. Although potatoes and sugarbeets showed little improvement in the treated soil they were easier to dig and came out of the ground cleaner. All of these crops were grown on soils treated with as little as 400-lb. of Monsanto's CRD-186 to the acre.

Little criticism of the artificial soil conditioners has developed as yet, since they are so new and have had such a surprising impact on the American agricultural industry. Obviously, the cost of the conditioners is of the utmost importance to the prospective user. With constant new developments in the conditioners and their proved efficiency, the expected demand will increase production and bring the present high cost to a moderate level. If the thousands of daily inquiries addressed to the manufacturers are any indication, public acceptance will be widespread.

Summary of Reports

SCIENTIFIC REPORTS OF THE INDIAN AGRICULTURAL RESEARCH INSTITUTE FOR THE YEAR ENDED 30th JUNE 1951

(Received on 22-1-1954†)

By J. Srinivasamurthy*

(Contribution 1 by the Agricultural Information Centre, Department of Agriculture, Bangalore)

AGRONOMY

1. Application of 120 lb. N per acre gave a significantly higher yield of potatoes than when the doses were 40 and 80 lb. N.

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* Library Research Assistant.

† A copy of the Report is available in the Central Library, Department of Agriculture, Seshadri Road, Bangalore, and may be consulted on any working day.—*Ed.*

2. Varieties of the following crops showed superior performances in a series of varietal trials : *Flax,* N.P. 21 ; *Tobacco* S. 19 ; *Sweet potato,* T.S.T. White ; *Sunnhemp,* C. 12 ; *Cotton,* F. 216 ; *Maize hybrids,* Australian hybrids, 431, 761 and 104 ; *Soyabean,* Monetta and Clemson ; *Jowar,* Parbhani 5.

3. Paddy crop did not respond to nitrogenous manuring in proportion to the doses of nitrogen applied to the crop, owing to the adverse effects of lodging which reduced the yield of grain.

4. Sunnhemp and cowpeas (as green manure) gave significantly higher yields of wheat than *guar* (*Cyamopsis*) (ಗೊರಬೀಕಾಯಿ). The application of phosphate to the green manure crop of sunnhemp at the time of burying was found to give better yields of wheat than application of phosphate to the green manure crop at the time of sowing.

5. Tractor ploughing at the normal time (*i.e.,* before transplanting) in the case of paddy gave the best results as opposed to bullock-drawn inversion and non-inversion ploughs used in preparing seedbed.

6. The costs of operation and operational rates of a few wheeled type tractors have been worked out.

	Farmall 'H' [4 cylinder kerosine engine (Petrol starting) 21·37 D.B.H.P.]	Allis Chalmer 'B' [4 cylinder kerosine engine (Petrol starting) 20·6 D.B.H.P.]	Ferguson [4 cylinder petrol engine 20·7 D.B.H.P.]
	Rs.	Rs.	Rs.
1 Purchase price ..	10,300	6,000	6,500
2 Cost per acre (including charges on implements)—			
(*a*) Ploughing ..	8·18	9·66	6·02
(*b*) Discing ..	2·95	1·79	2·41
(*c*) Grubbing ..	2·75	1·86	2·54
3 Cost per hour (for operation of tractor only)	5·24	3·57	4·20
4 Area covered per hour—	Acres	Acres	Acres
(*a*) Ploughing ..	0·67	0·39	0·738
(*b*) Discing ..	1·86	2·12	1·801
(*c*) Grubbing ..	1·96	2·00	1·708

Note—Acerage of ploughing per hour by Allis Chalmer is low because only one furrow plough was used. The Ferguson tractor is suitable for follow up cultivation and road-transport duties having a suitable road speed.

7. Manure sieving machine working was improved. Twenty-four tons of finished manure per day of 8 hours was the output. Rs. 2-10-0 and Re. 1 per ton were the costs for hand-operated rotary screen and the engine-operated screen respectively.

8. *Trial of Japanese Implements.*—Bullock-drawn cultivator (three-tyned) is found suitable for preparing seedbeds of crops like maize, cotton, etc., after the field had been ploughed by a mouldboard or *desi* plough. Also suitable for making ridges with the help of an additional attachment supplied. Useful for weeding and inter-row cultivation. Average draft: 165 lb.

Grain Screen.—It delivers 400 lb. of grain per hour and the output is estimated to be 550 lb. per hour if the screen is fed continuously.

9. Tractors with larger diameter wheels and improved and deep treads are more efficient for farm operations, where working in loose and wet soils without sliding or slipping is necessary.

10. A *'bakhar'* (blade harrow like *Doddakunte* with a blade 4'-0" long, 5" wide, $\frac{1}{4}$" thick) and a 'Bund former' were hitched behind a Fordson Major tractor and worked satisfactorily. Output for *Bakhar* was an acre per hour. More than one bund former can be hitched (to the cultivator frame) on to a tractor.

11. Mr. Dave's seed-drill fitted on a local plough gave an output of $\frac{1}{4}$ acre of sowing in 75 minutes with a seedrate of 41 seers of wheat per acre. Sowing is regular and seed does not get bruised. There is also saving of labour of one man. This seed-drill mechanism also works satisfactorily for groundnut seeds.

A seed-drill based on the same principle but of different design has been developed by the Division and is now awaiting field trial.

12. A disintegrator for crushing bone was tried using a tractor. The output of finished bonemeal was $1\frac{1}{4}$ tons per day of 8 hours, the cost being Rs. 37 per ton of crushed bone.

13. An improved bullock-drawn reaper (Viking Oil Bath Reaper Model D.O.) worked satisfactorily and gave a comparatively higher output than an ordinary bullock-drawn mower.

BOTANY

1. Three pungent (N.P. 46 A, hybrid 5-1-5 and Goa 20-1) and one non-pungent (R. 449) varieties of chilli stood out as high-yielding.

2. Hybrid maize: Dixie 11, U.S. 13, N.C. 27 and Indian 252 A gave high yields.

3. A new Indian wild species related to *Bhendi* (ಬೆಂಡೆ), *Abelmoschus tuberculatus* ($2n = 54$ chromosomes), which is conspicuously resistant to the common virus diseases of the cultivated varieties ($2n = 130$ chromosomes) is being utilised in breeding disease-resistant varieties of *Bhendi* (*Hibiscus esculentus*).

4. *Plant Hormones.*—Four varieties, N.P.165, C.228, N.P. 52 and Agra Local, were treated with 0·20 and 200 p.p.m. of indol-acetic acid in aqueous solution. The cut-leaf tips were dipped in the solution. The production of tillers as well as of ears was stimulated in Agra Local and in N.P. 52, the treatment with the 20 p.p.m. solution increased the number of fertile spikelets.

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

1. Soaking of wheat seeds in 0·5 molar solutions of ammonium nitrate and ammonium phosphate gave increased yield of wheat by 75 per cent. and 34 per cent. respectively. Soaking of sunnhemp seeds in 0·5 molar solution of potassium phosphate increased the green yield by 19 per cent.

2. Green manuring with leaves of leguminous plants—*Prosopis juliflora, Tephrosia purpurea, Cassia occidentalis* and *Crotaloria medicoginea* resulted in an increase in the yield of wheat grain by 192-275 per cent. over control, as compared to an increase by 180 per cent. on burying Berseem crop.

3. *Conservation and Utilisation of Human Urine as Manure.*—Saw dust and tea waste have a remarkable capacity of absorbing urine and retaining all the nitrogen without loss under moist condition of storage.

4. Lack of air-water balance in the root zone causes top yellowing of gram, a disease common in Delhi.

5. Indigenous phosphates such as bonemeal, Trichy nodule and Singhbhum phosphate (Raka mine) could best be utilised by applying them to sunnhemp for the green manure of wheat.

6. Certain methods of processing mango seed kernel (rich in carbohydrate fat and minerals) have been worked out. It has been estimated that about 140,000 tons of starch may be made available every year from this source.

ENTOMOLOGY

1. An unrecorded pteromalid hyperparasite on *Stenobracon deesœ* Cam., a potential parasite of the sugarcane borer and the maize borer was discovered.

2. *Bracon (microbracon) chilonis vier* was found to attack the maize stem-borer *Chilozenellus* Swinh.

3. *Effect of Insecticides on Potato Aphids.*—BHC and DDT + sulphur gave 91·87 per cent. and 84·42 per cent. control of *Myzus persicae* Sulz. *Aphis rhamni* Fonsc. was controlled by tobacco decoction (90·07), Gammexane (71·08) and fish oil soap (54·67).

MYCOLOGY AND PLANT PATHOLOGY

1. One collection of *Andropogon* Sp. from Orissa revealed itself as collateral host of wheat rust 34 of *Puccinia graminis tritici.*

2. The "Tundu" Disease [*Corynebacterium tritici* (Hutchinson) Bergey *et al.*] can be completely controlled by the removal of the nematoda galls, present along with *Corynebacterium* by flotation or sedimentation.

3. Efficacy of solar treatment of seed for the control of loose smut of barley was confirmed. [Infected barley seed was soaked in cold water for 1, 2, 3 and 4 hours and then exposed to sun on a brick floor for 4½ hours during June 1951 and sown in November 1951.]

4. *Sugarcane Red Rot.*—Four varieties reacted as highly resistant and 59 as moderately resistant and 18 varieties as highly resistant to nodal infection. The light highly sporing isolates of *Colletotrichum falcatum* Went. proved more virulent again.

5. B.P. 41, C. 38-1-2 and D. 419-2-4, the three varieties of Pigeon Pea proved to be resistant to the wilt disease.

6. Treatments of maize with Agrosan GN, Barbak, Spergon and copper carbonate gave 72·9, 77·1, 77·5 and 75·8 per cent. germination as against 66·4 per cent. of the untreated

control. The corresponding figures of yield were 94, 150, 114 and 114 lb. respectively as compared to 108 lb. of the control.

7. Studies on soft-rot of potatoes have shown that *Erwinia caratovora, E. aroideæ, E. atrospetica* are capable of causing rot of potato and that *Bacillus mesentericus* is almost saprophytic.

8. Mosaic diseases of bottlegourd caused by *Cucumis virus* 2 c.c. is carried symptomlessly in *Datura stramonium, Nicotiana tabacum, N. tabacum* var. *White burley, Solanum nigrum* and *S. nodiflorum* but fails to infect *Lycopersicum esculentum* and *Capsicum annum.*

9. Alternation of the tomato leaf curl virus (*Nicotiana virus* 10) by passage through *Capsicum annum* has been confirmed and by successive passage through tomato and Datura has been observed. Disease could be kept greatly under check by weekly spraying with fish oil rosin soap.

10. Enation mosaic of *Hibiscus rosa sinensis* and leaf curl of *Bhendi* have been shown to be identical and the disease is transmitted to *Bhendi* by the insect vector *Benusia tabaci.*

News & Announcements

New Fellows of the Royal Society

Among the 25 new members elected to Fellowship of the Royal Society on March 18, 1954, are :

1. Dr. H. W. Lissman, Assistant Director of Research, Department of Zoology, University of Cambridge.
2. Dr. L. Harrison Matthews, Director, Zoological Society of London.
3. Prof. R. D. Preston, Professor of Plant Biophysics, University of Leeds.
4. Dr. T. W. S. Pringle, Lecturer in Zoology, University of Cambridge, distinguished for his researches on neuromuscular co-ordination and the mechanism of equilibration in insects.
5. F. J. Richards, Senior Principal Scientific Officer, Research Institute in Plant Physiology, Imperial College of Science and Technology, London.

6. Dr. C. B. Williams, Head of the Department of Entomology, Rothamsted Experimental Station.

Linnean Medal

The Linnean Gold Medal for 1954 was awarded to Prof. F. E. Fritsch, Emertius Professor of Botany in the University of London.

Prof. W. B. Brierly

Prof. W. B. Brierly retires from the Chair of Agricultural Botany in the University of Reading in September and will be succeeded by Prof. D. W. Goodall of the University College of Gold Coast. Prof. Brierly was the first head of the Plant Pathology Department at Rothamsted till 1932 when he went to Reading. He was Hon. Editor of *The Annals of Applied Biology* for 25 years.

Dr. T. R. Furlong, O.B.D., A.R.I.C.

Dr. T. R. Furlong, Deputy Director of the Colonial Products Advisory Bureau, retired on 31-12-1953 after 43 years of distinguished service. During this long period he acquired a rich and wide experience in colonial plant and animal products and he was, in great measure, responsible for the development in their production and use in commerce. He specialised in hides and skins and edited that excellent monograph "The Preparation of Empire Hides and Skins" for the Imperial Institute. He also took great interest in the production of pyrethrum. After his retirement he has joined the Kenya Pyrethrum Board. He is succeeded by H. T. Islip at the Colonial Products Laboratory.

Sir Raymond Priestley

Sir Raymond Priestley, Chairman of the Governing Body of the Imperial College of Tropical Agriculture, Trinidad, retired at the end of 1953. Sir Raymond had a varied and interesting career. He was a geologist to the Antarctic Expedition in 1907-09, Principal, and later Vice-Chancellor of the Birmingham University. He joined the Governing Body of I.C.T.A. in 1949 and as its Chairman strove hard to stabilise the finances of the college and strengthen its staff and equipment.

Prof. Sir Frank Engledow, C.M.G., M.A., F.R.S., of the School of Agriculture, Cambridge University, succeeds Sir Raymond. With his long and intimate experience of both tropical

and temperate agriculture, the I.C.T.A. will no doubt prosper under his Stewardship.

Mr. S. F. Ashby

Sydney F. Ashby, formerly Director of the Commonwealth Mycological Institute, died on March 6, 1954, at the age of 79. Mr. Ashby was educated at Edinburgh. He worked in the Department of Bacteriology for sometime at Rothamsted and then joined the Jamaica Department of Agriculture from where he went to the Imperial College of Tropical Agriculture, Trinidad, as Professor of Mycology. Later he became Director of the Commonwealth Bureau of Mycology and retired from that post in 1939.

Prof. James Basil Buston

Death is reported of Prof. James Basil Buston, Principal and Dean of the Royal Veterinary College on May 25, 1954.

Dr. E. M. Crowther

To many students of soil science and agriculture it will come as a shock to learn that Dr. E. M. Crowther, Deputy Director of Rothamsted Station, died suddenly on March 12th at the early age of 56. Educated at Leeds, he joined Rothamsted in 1917. Ten years later he was chosen to head the Chemistry Department and in 1950 he became one of the two Deputy Directors of the Station. He was among the pioneers to apply statistical methods developed by Fisher and Yates to field experiments. He was a great authority on fertilisers and was responsible for major improvements in their use, particularly during the War when there was a shortage of potash. He was also among the pioneers in using radio tracer techniques, particularly in respect of the immobilisation of phosphates in soil. He made very important contributions to the development of silico phosphates as fertilisers. By showing that properly balanced fertilisers are as effective as compost, he was instrumental in revolutionising manuring practice in forest nurseries.

He had also a wide knowledge of agriculture of lands other than his own. He was an active member of the Committee for Colonial Agricultural, Animal Health and Forestry Research.

He was one of the editors of the *Journal of Agricultural Science* and *Empire Journal of Experimental Agriculture.* He was also a Sectional President in 1951 of the British Associa-

tion for the Advancement of Science and President for two years of the British Society of Soil Science and Fertilisers.

In the words of Dr. W. G. Ogg, Director of Rothamsted, "In him, world agronomy has lost one of its foremost workers". —*With grateful acknowledgements to 'Nature'* 173, (4441) 893 and Dr. W. G. Ogg.

Agricultural History Society

The British Agricultural History Society, which was formed an year ago (C/o. Museum of English Rural Life, 7, Shinfield Road, Reading : Subscription : 1 guinea per year) has issued its first volume of *Agricultural History Review.* The Society was founded with the object of bringing together all those interested in agriculture, "as a living historical process whether their sphere of activity lies in academic institutions or in the countryside".

Conference on Soil Microbiology

The American Society of Agronomy, the Soil Science Society of America and Purdue University sponsored a Conference on Soil Microbiology during June of this year. Among subjects discussed were, 'Physical Properties of Soils as Affected by Microbial Activities', 'Maintenance of Soil Organic Matter', 'Organic Matter Transformations'.

Tenth World's Poultry Congress

The Tenth World's Poultry Congress opened at Edinburgh on August 13th. It was first held at the Hague in 1921. Except during war years it has been held every three years. The last Congress to be held in Great Britain was in 1930. More than 110 papers from scientists in 20 different countries were accepted.

Royal Agricultural Society's Show

The Royal Show was held in Windsor Great Park, one of the Royal Estates of Queen Elizabeth, from July 6th to 9th. The Royal Show is the largest of its kind in the world and is regarded as the shop window of British farming. It costs about £ 150,000 (Rs. 20 lakhs) to stage each Royal Show. The Show is organised by the Royal Agricultural Society of England, founded in 1838. The first Show was held at Oxford in 1839, on seven acres of land whereas this year's showground covered 151 acres *plus* a similar area for car parks ! Queen Elizabeth who is the patron of the Society was also this year's President.

Tracer Techniques in Indian Agriculture

Under an Indo-U.S. Technical Co-operation Agreement, the Indian Agricultural Research Institute at New Delhi will conduct experiments with phosphorus isotopes to determine the adequacy or otherwise of phosphorus in Indian soils. This vital information will help the India Government to decide whether they should undertake production of phosphatic fertilisers in addition to nitrogenous fertilisers already being produced at the giant Sindhri Factory.

An officer of the Institute has already been trained in U.S.A., in the use of radioactive material in agricultural research. A central radio-tracer laboratory with green house is being set up at I.A.R.I. with Geiger counters, scalers, etc.—

Popularisation of Fishmeal

The F.A.O. at a Conference held in August 1954 at Hong Kong have, it is learnt, decided to explore the possibility of fishmeal in South-Asian countires where the protein content of the average meal is very low. Fishmeal contains about 70 per cent. protein. Norway and other Scandinavian countries have been approached to make available fishmeal at subsidised rates.

Coir Board

The Coir Board opened by the Rajpramukh of T.-C. State in August is the fifth of the Industrial Boards to come under Commerce and Industry Ministry. The coir industry depends heavily on the export market, where other hard fibres useful in the fabrication of floor covering have been strong competitors and it is the object of the Coir Board to place this agro industry on a sound basis.

Correspondence

Re: Use of Folidol E 605, against Kakada (Jasmine) mites

I HAVE over 8,000 plants of Kakada and was sustaining losses year after year for the last fifteen years due to severe attack of mites. I came to know from the District Horticultural Inspector, Bangalore, that there is a German preparation which could be tried for this trouble and I immediately contacted Messrs. Rangaswamy & Co., 5th Main Road, Gandhinagar,

Bangalore-2, from whom I bought Folidol E 605 and sprayed in a concentration of 1 c.c. per gallon. I gave three applications in an interval of 10 days and now it is two months and the plants doubled themselves with alround new flushes and the new flushes are completely free from mite attack. The damage caused by mite attack is popularly known as *Majjigeroga* (ಮಜ್ಜಿಗೆ ರೋಗ). I request you to publish this note in your esteemed journal so that the other co-cultivators may derive benefit.

Attibele. A. R. RAMIAH.

A large number of errors have nexcusably crept in in the letter published on p. 138 of the previous number. The corrected letter is re-published with apologies to the correspondent.—*Ed.*

ROLE OF PLASTICS IN PLANT CULTURE

In continuation of my note on the "Role of Plastics in Plant Culture" published in the *Mysore Agricultural Journal* [Vol. 30 (2), 82-90] I am listing hereunder the number of days taken by different species of plants for rooting by air-layering (Gootying by ring barking) in plastic covers.

Name of the Plant	Date of gootying	Date of rooting	Days taken to root
Guava, *Psidium guava* ..	16-6-54	26-8-54	70
Rose ..	18-6-54	26-7-54	38
Mango ..	18-6-54	23-9-54	95
Litchi ..	19-6-54	3-8-54	45
Callophyllum ionophyllum ..	17-6-54	30-7-54	43
Dillenia indica ..	17-6-54	15-7-54	29
Bignonia gracilis ..	17-6-54	24-7-54	37
Garcinia Livingstonii ..	17-6-54	29-7-54	42
Lagunaria Patersonii ..	17-6-54	24-7-54	37
Nerium oleander fl. pl. ..	12-6-54	30-6-54	17

M. R. ANANDARAMIAH.

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